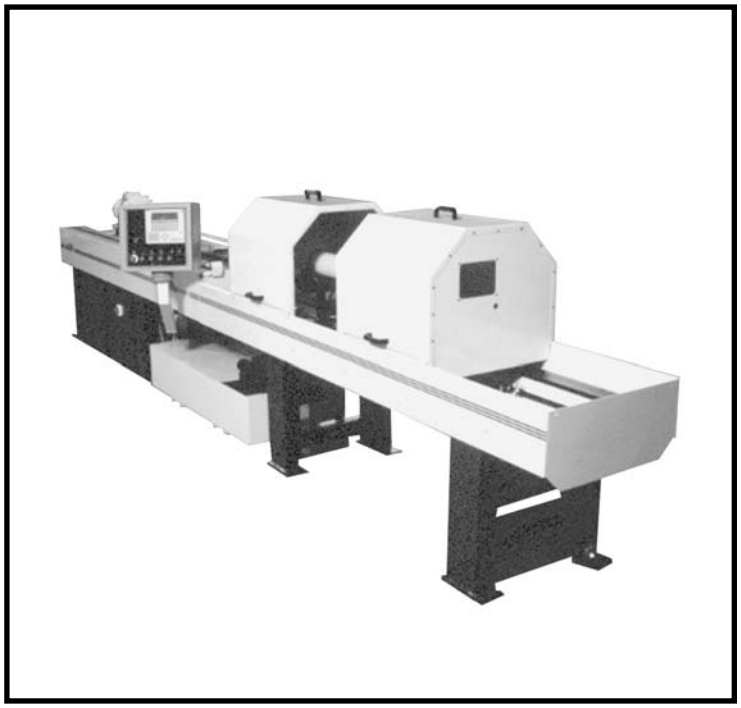
Installation, Setup and Operation

INSTRUCTIONS



for

CE

SUNNEN® TUBE HONE

STH-Series - 2, 4, & 6 meter machines

READ THE FOLLOWING INSTRUCTIONS THOROUGHLY AND CAREFULLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE SUNNEN® TUBE HONE.

"SUNNEN, THE SUNNEN LOGO, GENERAL HONE AND THE GENERAL HONE LOGO ARE REGISTERED TRADEMARKS OF SUNNEN PRODUCTS COMPANY."

SUNNEN® PRODUCTS COMPANY • 7910 MANCHESTER AVENUE • ST. LOUIS, MO 63143, U.S.A. • PHONE: 314-781-2100

GENERAL INFORMATION

The Sunnen® equipment has been designed and engineered for a wide variety of parts within the capacity and limitation of the equipment. With proper care and maintenance this equipment will give years of service.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY AND THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THIS EQUIPMENT.

IMPORTANT: Read any supplemental instructions BEFORE installing this equipment. These supplemental instructions give you important information to assist you with the planning and installation of your Sunnen equipment.

Sunnen Technical Service Department is available to provide telephone assistance for installation, programming, & troubleshooting of your Sunnen equipment. All support is available during normal business hours, 8:00 AM to 4:30 PM Central Time.

Review all literature provided with your Sunnen equipment. This literature provides valuable information for proper installation, operation, and maintenance of your equipment. Troubleshooting information can also be found within the Instructions. If you cannot find what you need, call for technical support.

Where applicable, programming information for your Sunnen equipment is also included. Most answers can be found in the literature packaged with your equipment.

Help us help you. When ordering parts, requesting information, or technical assistance about your equipment, please have the following information available:

- Have ALL MANUALS on hand. The Customer Services Representative or Technician will refer to it.
- Have Model Number and Serial Number printed on your equipment Specification Nameplate.
- Where Applicable: Have Drive model and all nameplate data. Motor type, brand, and all nameplate data.

For Troubleshooting, additional information may be required:

- Power distribution information (type - delta, wye, power factor correction; other major switching devices used, voltage fluctuations)
- Installation Wiring (separation of power & control wire; wire type/class used, distance between drive and motor, grounding).
- Use of any optional devices/equipment between the Drive & motor (output chokes, etc.).

For fast service on your orders call:

Sunnen Automotive Customer Service toll free at: 1-800-772-2878

Sunnen Industrial Customer Service toll free at: 1-800-325-3670

Customers outside the USA, contact your local authorized Sunnen Distributor.

Additional information available at: http://www.sunnen.com or e-mail: sunnen@sunnen.com

NOTE: Sunnen reserves the right to change or revise specifications and product design in connection with any feature of our products contained herein. Such changes do not entitle the buyer to corresponding changes, improvements, additions, or replacements for equipment, supplies or accessories previously sold. Information contained herein is considered to be accurate based on available information at the time of printing. Should any discrepancy of information arise, Sunnen recommends that user verify the discrepancy with Sunnen before proceeding.

ESD PREVENTION REVIEW

Let's review the basics of a sound static control system and its effective implementation. First, in the three step plan:

1. Always ground yourself when handling sensitive components or assemblies.
2. Always use a conductive or shielded container during storage or transportation. These materials create a Faraday cage which will isolate the contents from static charges.
3. Open ESD safe containers only at a static safe work station.

At the static safe work station, follow these procedures before beginning any work:

A. Put on your wrist strap or foot grounding devices.

B. Check all grounding cords to make sure they are properly connected to ground, ensuring the effective dissipation of static charges.

C. Make sure that your work surface is clean and clear of unnecessary materials, particularly common plastics.

D. Anti-static bubble wrap has been included for use at the machine when an ESD safe workstation is not available.

You are now properly grounded and ready to begin work. Following these few simple rules and using a little common sense will go a long way toward helping you and your company in the battle against the hazards of static electricity. When you are working with ESD sensitive devices, make sure you:

GROUND

ISOLATE

NEUTRALIZE

SUNNEN® LIMITED PRODUCT WARRANTY

Sunnen® Products Company and its subsidiaries (SPC) warrant that all new SPC honing machines, gaging equipment, tooling, and related equipment will be free of defects in material and/or workmanship for a period of one year from the date of original shipment from SPC.

Upon prompt notification of a defect during the one-year period, SPC will repair, replace, or refund the purchase price, with respect to parts that prove to be defective (as defined above). Any equipment or tooling which is found to be defective from improper use will be returned at the customer's cost or repaired (if possible) at customer's request. Customer shall be charged current rates for all such repair.

Prior to returning any SPC product, an authorization (RMA#) and shipping instructions must be obtained from the Customer Service Department or items sent to SPC will be returned to the customer.

Warranty Limitations and Exclusions This Warranty does not apply to the following:

- Normal maintenance items subject to wear and tear: (belts, fuses, filters, etc).
- Damages resulting from but not limited to:
  - › Shipment to the customer (for items delivered to customer or customer's agent F.O.B., Shipping Point)
  - › Incorrect installation including improper lifting, dropping and/or placement
  - › Incorrect electric power (beyond +/- 10% of rated voltage) including intermittent or random voltage spikes or drops
  - › Incorrect air supply volume and/or pressure and/or contaminated air supply
  - › Electromagnetic or radio frequency interference from surrounding equipment (EMI, RFI)
  - › Storm, lightning, flood or fire damage
  - › Failure to perform regular maintenance as outlined in SPC manuals
  - › Improper machine setup or operation causing a crash to occur
  - › Misapplication of the equipment
  - › Use of non-SPC machines, tooling, abrasive, fixturing, coolant, repair parts, or filtration
  - › Incorrect software installation and/or misuse
  - › Non-authorized customer installed electronics and/or software
  - › Customer modifications to SPC software

THE LIMITED WARRANTY DESCRIBED HEREIN IS EXPRESSLY IN LIEU OF ALL ANY OTHER WARRANTIES. SPC MAKES NO REPRESENTATION OR WARRANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, WHETHER AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER MATTER. SPC IS NOT RESPONSIBLE FOR THE IMPROPER USE OF ANY OF ITS PRODUCTS. SPC SHALL NOT BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO: LOSS OF USE, REVENUE, OR PROFIT. SPC ASSUMES NO LIABILITY FOR PURCHASED ITEMS PRODUCED BY OTHER MANUFACTURERS WHO EXTEND SEPARATE WARRANTIES. REGARDLESS OF ANY RIGHTS AFFORDED BY LAW TO BUYER, SPC's LIABILITY, IF ANY, FOR ANY AND ALL CLAIMS FOR LOSS OR DAMAGES WITH RESPECT TO THE PRODUCTS, AND BUYER'S SOLE AND EXCLUSIVE REMEDY THEREFORE, SHALL IN ALL EVENTS BE LIMITED IN AMOUNT TO THE PURCHASE PRICE OF THAT PORTION OF THE PRODUCTS WITH RESPECT TO WHICH A VALID CLAIM IS MADE.

Shipping Damages

Except in the case of F.O.B., Buyer's destination shipments, SPC will not be liable for any settlement claims for obvious and/or concealed shipping damages. The customer bears the responsibility to unpack all shipments immediately and inspect for damage. When obvious and/or concealed damage is found, the customer must immediately notify the carrier's agent to make an inspection and file a claim. The customer should retain the shipping container and packing material.

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Any alteration or reverse engineering of the software is expressly forbidden and is in violation of this agreement.

SPC reserves the right to update the software covered by this agreement at any time without prior notice and any such updates are covered by this agreement.

SAFETY INSTRUCTIONS

READ FIRST

This machine, like any equipment, may be dangerous if used improperly. Please read all warnings and instructions before attempting to use this machine.

Always disconnect power at main enclosure before servicing machine.[1]

Always wear eye protection when operating this machine.

NEVER open or remove any machine cover or protective guard with power "ON." Always disconnect power at main enclosure before servicing this equipment.[1]

DO NOT attempt any repair or maintenance procedure beyond those described in this book. Contact your Sunnen® Field Service Engineer or Technical Services Representative for repairs not covered in these instructions.

Due to the wide variety of machine configurations, all possibilities cannot be described in these instructions. Instructions for safe use and maintenance of optional equipment ordered through Sunnen, will be provided through separate documentation and/or training provided by your Sunnen Field Service Engineer or Technical Services Representative.

DO NOT attempt to defeat any safety device on this machine or on any of the optional equipment.

If specially built automation components are added to this system, be sure that safety is not compromised. If necessary, obtain special enlarged work area safety system from Sunnen Products Co.

CE Indicates CE version ONLY.

[1] DO NOT touch electrical components until main input power has been turned off and *CHARGE* lamps are extinguished. WARNING: The capacitors are still charged and can be quite dangerous.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS v
LIST OF APPENDIXES vi
INTRODUCTION vi
GENERAL INFORMATION & SPECIFICATIONS vii
FLOOR LAYOUT (Configuration) viii

INSTALLATION 1
Purpose 1
Suggested Tooling 2
Installation 2
Pneumatic Connection 4
Electrical Requirements 4
Electrical Connection 5
Coolant Reservoir 5
Magnetic Separator (Optional) 5
Special Fixture (Optional) 5
Operational Check 6

PREPARING FOR OPERATION 7
General 7
Major Components 7
Emergency Switch 7
Controls 7
Safety Symbols 10
Workholding Fixture 10
Honing Tool 11
Spindle Carriage 12
Spindle Carriage (Optional) 13

SETUP AND OPERATION 15
General 15
Safety Precautions 15
Operating Hints 15
Setup & Operation 15

ROUTINE MAINTENANCE 19
General 19
Cleaning 19
Lubrication 19
Chain 20
Coolant Reservoir 20

TROUBLESHOOTING 23
General 23
Operational Troubleshooting 23

APPENDIXES

A Check List, Setup & Operation 25
B Check List, Work Cycle Sequence 27
C Screens 29
D Calculations Formulas 33
E Crosshatch Angle 34
F Pneumatic Flow Diagram 35
G Coolant Flow Diagram 36
H Surface Roughness Table 37
I Fixture Height Chart (L-Series) 38
J Fixture Height Chart (H-Series) 39

INTRODUCTION

This Instruction Manual is provided to give the information required to install, operate, and maintain the STH-Series Sunnen® Tube Hones, models STH-2000, -4000, & -6000.

As there are numerous Workpieces that can be honed on this machine, all possible combinations cannot be discussed here. The determining factor as to whether a particular part or material can be honed in the machine will come with experience from working with the machine in your shop.

When ordering parts for, or requesting information about your machine, include the serial number of your machine.

READ THE FOLLOWING INSTRUCTION THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE SUNNEN® TUBE HONE.

GENERAL INFORMATION & SPECIFICATIONS

Sunnen® Tube Hone - STH-Series

Model:	STH-2000L	STH-4000L	STH-6000L
Diameter Range (OD)[1]:	30 - 370 mm (350 - 600 mm with special fixturing) 1.2 - 14.5 in. (13.8 - 24 in. with special fixturing)		
Workpiece Weight[1]:	1815 kg (4000 lbs.)		
Stroke Length Range[1]:	Up to 2 m (78 in.)	Up to 4 m (157 in.)	Up to 6 m (236 in.) Up to 8 m (315 in.)
Stroke Rate:	Up to 40 mpm (130 fpm)		
Stroke Motor:	3,3 kW (4.4 hp)		
Stroke Motor (Optional):	4,2 kW (5.6 hp)		
Spindle Speeds:	68 to 340 rpm (Opt: 47-234; 38-188; 30-148)		
Spindle Motor:	3 kW (4 hp)		
Spindle Motor (Optional):	5,5 kW (7.4 hp)		
Coolant Pump:	Centrifugal pump		
Pump Motor:	0,187 kW (1/4 hp)		0,56 kW (3/4 hp)
Coolant Capacity:	235 L (62 gal.)		500 L (132 gal.)
Pump Rate:	38 LPM (10 GPM)		113,6 LPM (30 GPM)
Coolant Requirements:	Sunnen Industrial Honing Fluids		
Floor Space -			
Length:	6255 mm (246.1 in.)	10255 mm (456.7 in.)	14755 mm (580.9 in.)
Depth:	1289 mm (50.7 in.)	1289 mm (50.7 in.)	1289 mm (50.7 in.)
Height:	1505 mm (59.3 in.)	1505 mm (59.3 in.)	1505 mm (59.3 in.)
Floor Weight (Dry):	2200 kg (4851 lbs.)	3000 kg (6615 lbs.)	4200 kg (9261 lbs.)
Floor Load:	739 kg/sq. meter (151 lbs./sq. ft)		
Pneumatic Requirements:	30 LPM @ 5,4 Bar (1 CFM @ 80 PSI)		
Electrical Requirements:	230/460V, 60Hz, 3Ph 380/400V, 50Hz, 3Ph		
Color:	Pearl Gray / Pewter Gray / Burgundy Trim		
Noise Emission:	Less than 76 dB(A) continuous Less than 78 dB(A) peak Load (max. noise) condition in a typical factory environment.		

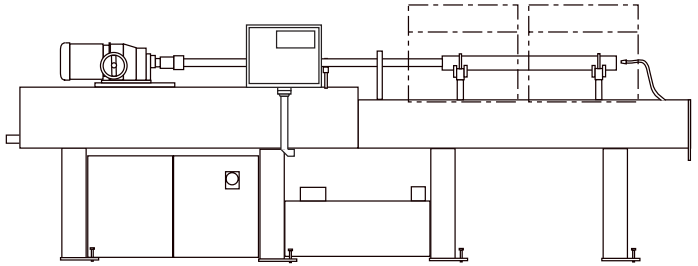
[1] Diameter range, length range, and workpiece weight are contingent on workpiece and application.

Floor Loading:
Less than 739 kg/sm (151 lbs/sf).

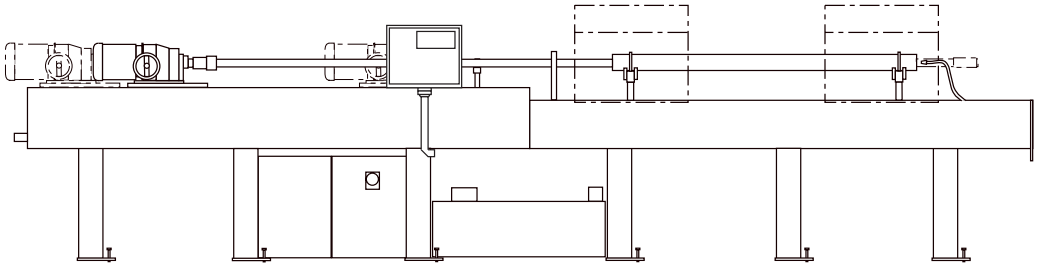
STH-2000: 6255L x 1289D x 1505H mm
(246.1 x 50.7 x 59.3 in.)

STH-4000: 10255L x 1289D x 1505H mm
(456.7 x 50.7 x 59.3 in.)

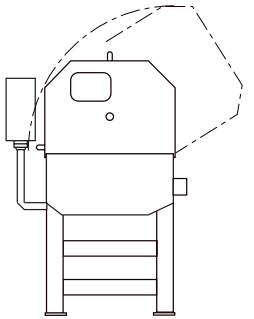
STH-6000: 14755L x 1289D x 1505H mm
(580.9 x 50.7 x 59.3 in.)



STH-2000/-4000, FRONT VIEW



STH-6000, FRONT VIEW



SIDE VIEW

SECTION 1
INSTALLATION

PURPOSE

This Section is designed to aid user in unpacking, inspecting, and installing Sunnen® Tube Hone, models STH-2000, -4000, & -6000. Hereafter, referred to as the Machine (see Figure 1-1).

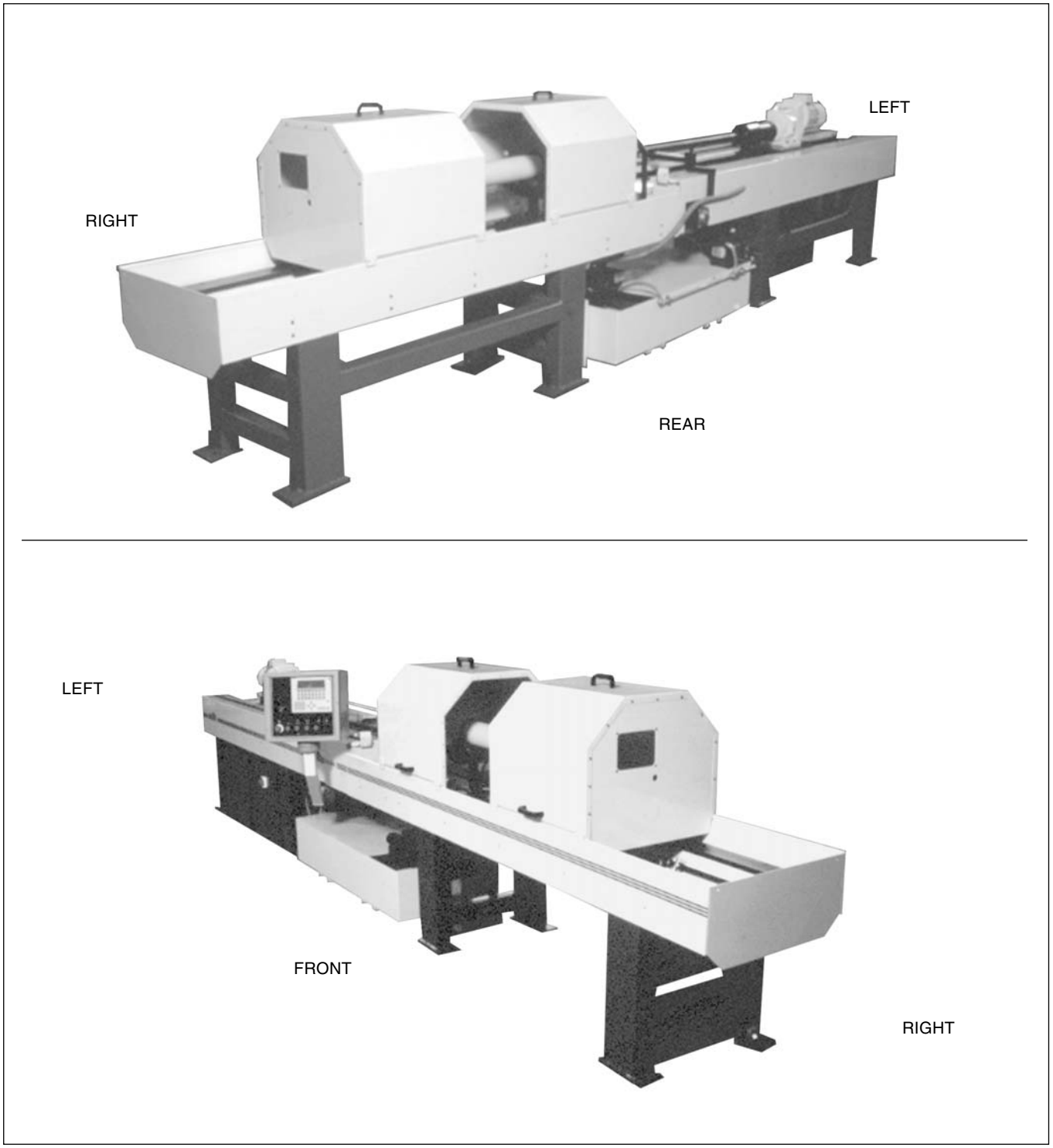


FIGURE 1-1, Tube Hone

TOOLS & MATERIALS

The following tools and materials are required for unpacking and installing machine:

Wire Cutters/Strippers	Knife
Screw Driver (Std. nose)	Hammer
Slip-Joint Pliers	Crow Bar
Cleaning Solvent	Tin Snips
Open End Wrench (17, 19, & 24 mm / 3/4in.)	

INSTALLATION

Read the following instructions carefully and thoroughly before unpacking and inspecting Machine. All references to right and left in these instructions are, unless otherwise noted, as seen by the operator as one looks at Machine or assembly being described.

1. Cut, remove and discard shipping bands.

2. Remove top and front of shipping crate.

3. Remove Components from crate, and remove protective packing material from the components.

4. Remove (2) Lift-Off Type Coolant Splash Hoods from work base and set them aside.

5. Remove Operator Control Console Assembly and set it aside.

6. Remove hardware from coolant reservoir.

7. Remove eight bolts securing Tables Support Feet to bottom of crates, using 3/4 in. open end wrench.

8. Install lifting straps/chains (not supplied) around center support tube at rear of machine base and around lifting bracket at front of machine base.

9. Remove machine base from skid and set it in place.

10. Install lifting straps/chains (not supplied) through four M12 lifting eyes (supplied) in Fixture Base Plates. (Verify Fixture Base Plates are secured to Work Base Ways before attempting to lift Work Base.)

CAUTION

Install (2) yellow Electrical Barrel type plugs (Photo Eye Cables) through grommetted holes in work base sheet metal as bases come together.

11. Remove work base from skid and set it in line with machine base.

12. Inspect Machine and Components for dents, scratches, or damage resulting from improper handling by carrier. If damage is evident, ***immediately*** file a claim with carrier.

13. Place a machinist level on spindle carriage base plate and level machine by adjusting Leveling Bolts on Support Feet, using a 24 mm Open End Wrench (see Figure 1-3).

NOTE: Align Work Base to Machine Base.

FIGURE 1-2, Align Bases

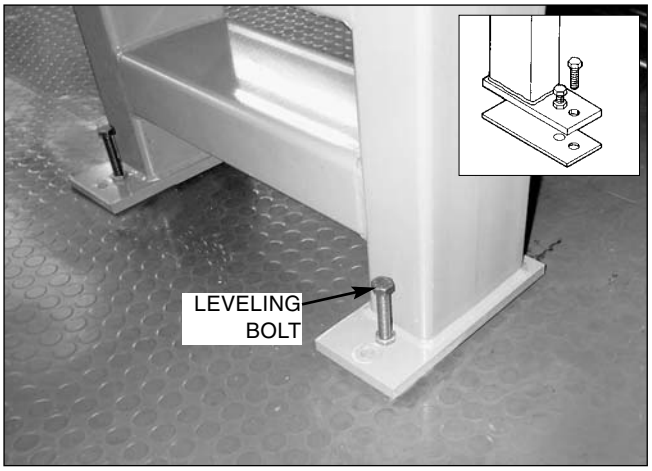


FIGURE 1-3, Leveling Bolts

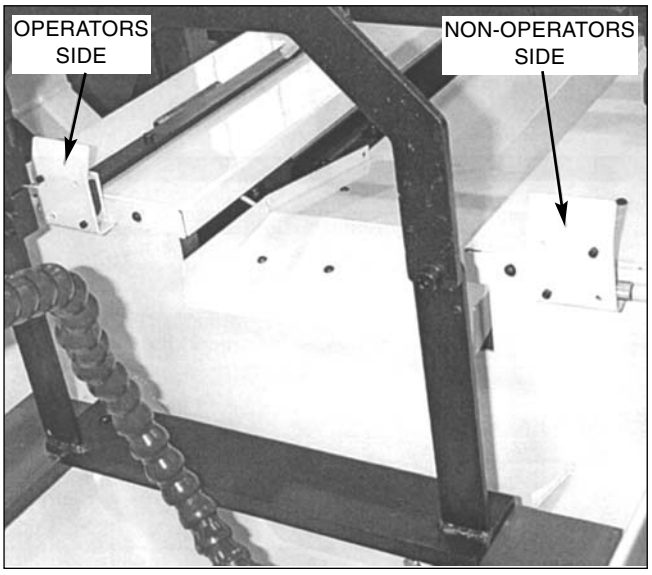


FIGURE 1-4, Sensor Units

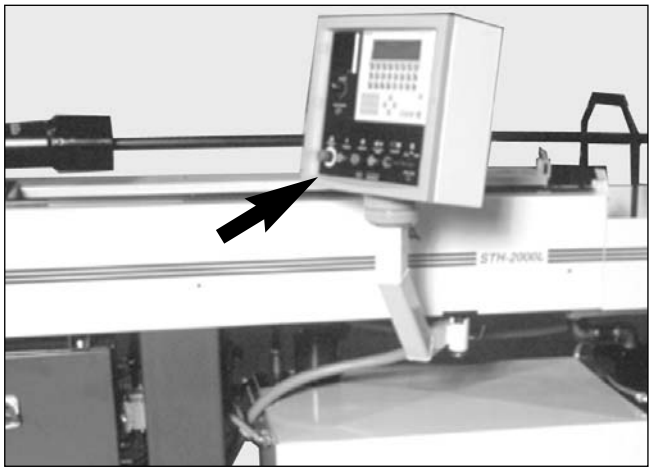


FIGURE 1-5, Operator Control Console

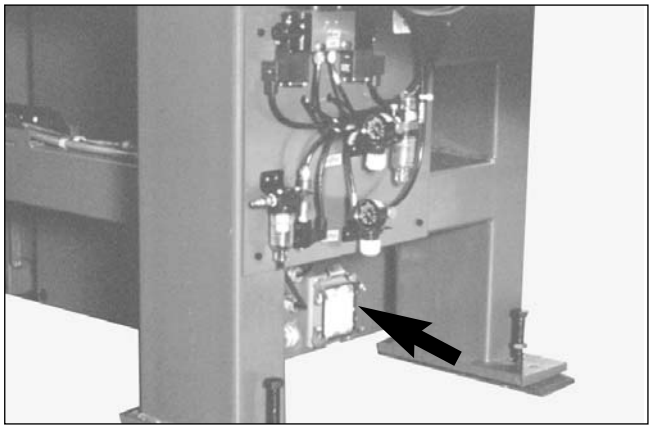


FIGURE 1-6, Electrical Connections

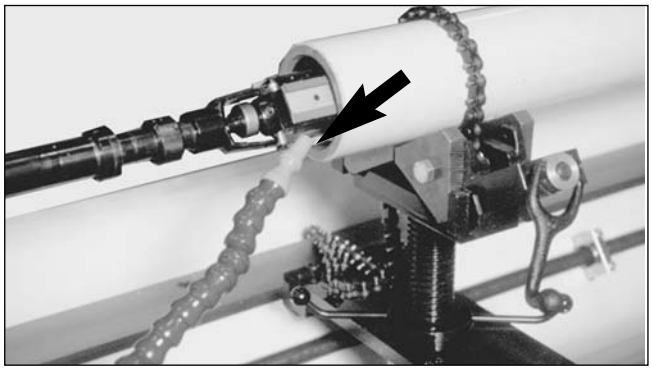


FIGURE 1-7, Coolant Nozzle

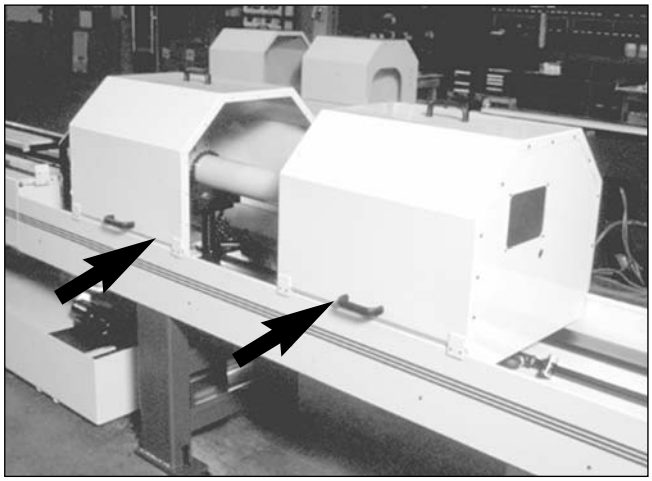


FIGURE 1-8, Splash Guards

Level work base using hex head leveling bolts supplied. (Leveling bolts and jam nuts were packaged with hardware in coolant reservoir.)

14. Align both Bases, then install M16 Bolts between Tables (see Figure 1-2). (Bolts were packaged with hardware in coolant reservoir.)

NOTE: Two M16 Bolts for connecting Machine Bases are supplied.

CAUTION

DO NOT move Machine once Bolts are installed. Serious damage may be caused to Bases if Machine is lifted once Bolts are installed.

15. Remove lifting bracket from front of machine and install drip pan (STH-2545) using four screws (M6x8 BHCS).

16. Remove spindle carriage shipping bracket and replace two screws (M6x12 BHCS). Use same screws to mount electical conduit support.

17. For permanent installation, secure Machine's Support Feet to Floor with appropriate fasteners (*not supplied*).

18. Install machine base to work base drain hose to work base hose barb fitting.

19. Install and align (2) yellow electronic Sensor Units (Photo Eyes) to sheet metal of work base at machine base/work base joint (see Figure 1-4).

CAUTION

Serious damage will be caused to the spindle carriage if spindle carriage is initialized or moved before lifting straps are removed !

20. Attach Operators Control Console: Attach Arm to underside of machine base and securing with supplied washer and hitch pin (see Figure 1-5).

Route and connect electrical plug to electrical enclosure, through conduit clamp (see Figure 1-6).

21. Install coolant reservoir under machine and connect coolant hoses.

Clean coolant supply, work base drains & machine base to work base drain.

Route and connect electrical plug to electrical enclosure (refer to Figure 1-6).

22. If supplied: Position container under discharge chute of magnetic filter.

23. Remove four (4) M12 lifting eyes from work holding fixtures (see Figure 1-7).

24. Check Coolant Nozzles (refer to Figure 1-7).

25. Position two Splash Guards on Machine (see Figure 1-8).

26. Inspect Safety Arch on work base. Requires 10mm Hex Wrench (see Figure 1-9).

27. Clean Spindle Carriage Ways with solvent to remove anti-rust and any foreign materials. After this, lightly lubricate with Oil.

PNEUMATIC CONNECTION

Connect pneumatic line (airline) as follows (see Figure 1-10):

NOTE: The Factory Air Supply Line is not supplied. A minimum of 0,55 MPa (80 psi) clean, dry compressed air is required for proper operation.

1. Install Quick-Disconnect (not supplied) in airline port on Airline Filter Regulator.
2. CONNECT 1/2 in. (13 mm) factory air supply line (not supplied) to Quick-Disconnect (not supplied).
3. Airline Filter Regulator Valve: This valve is preset at the factory to 0,55 MPa (80 psi).

ELECTRICAL REQUIREMENTS

All wiring is to be performed by a competent, Licensed Electrician in accordance with all local, state, and federal codes and regulations; along with any special information provided on machine nameplate or electrical specification plate.

WARNING

All wiring and electrical equipment service should be performed by authorized personnel ONLY.

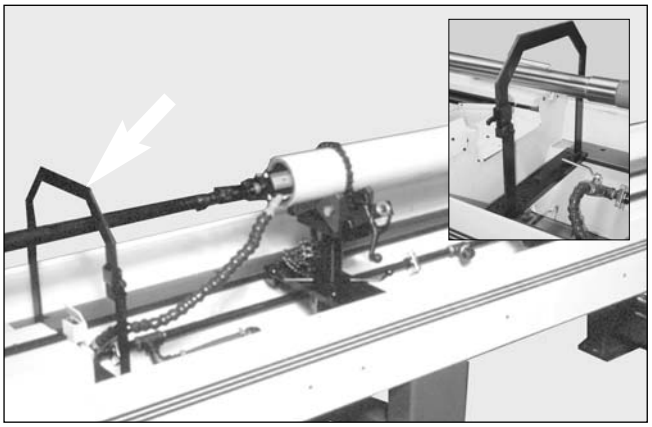


FIGURE 1-9, Safety Arch

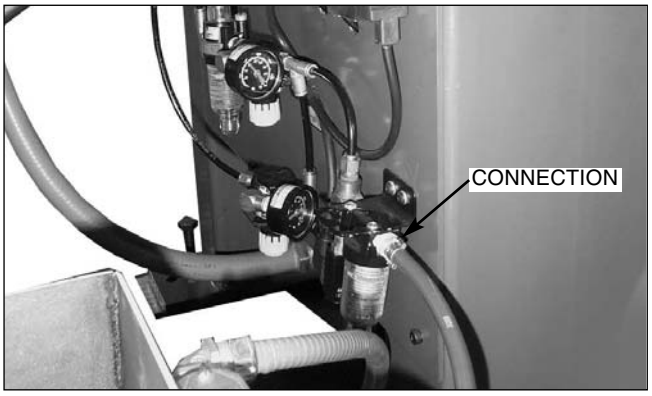


FIGURE 1-10, Pneumatic

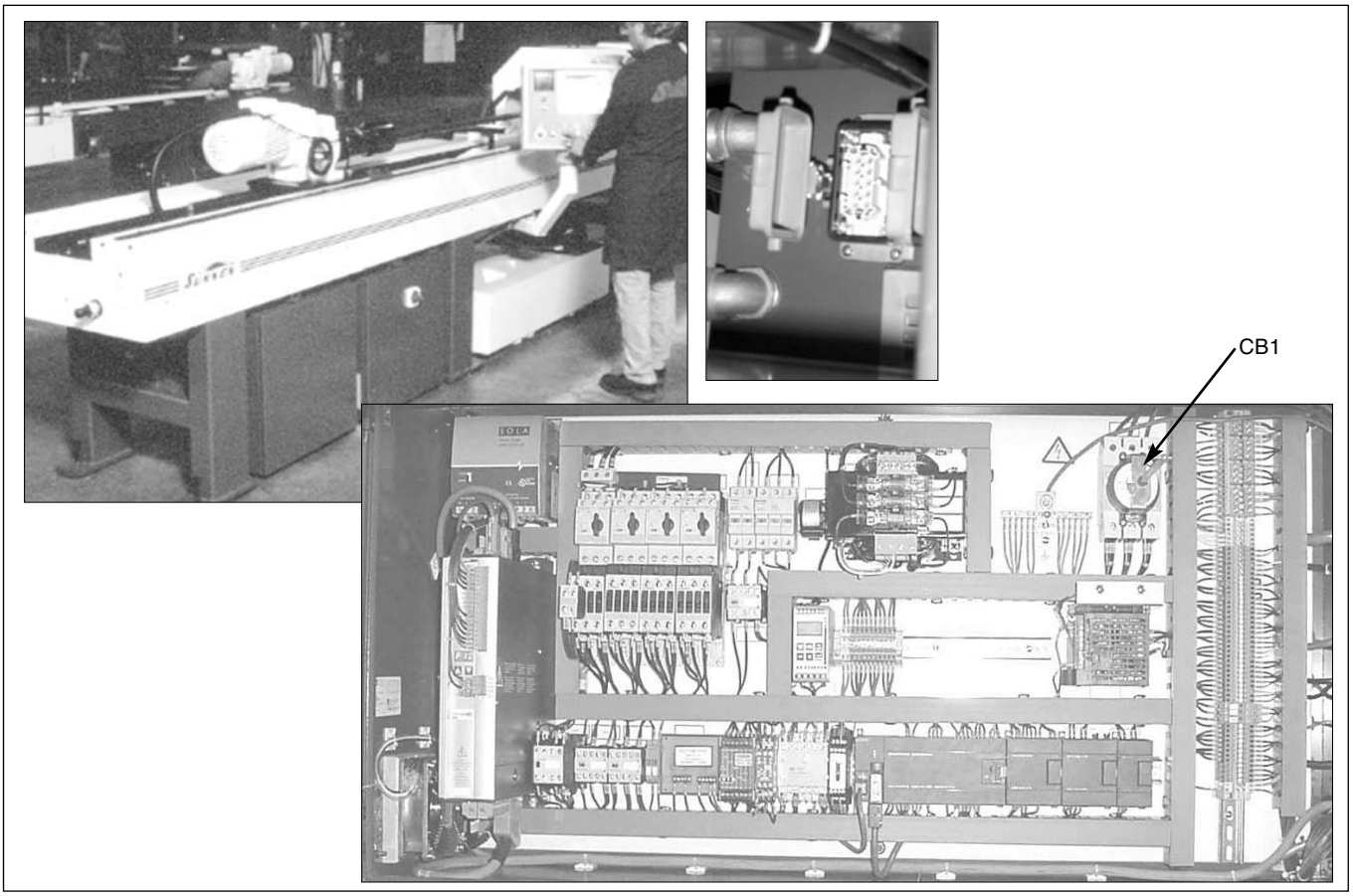


FIGURE 1-11, Electrical Control Enclosure

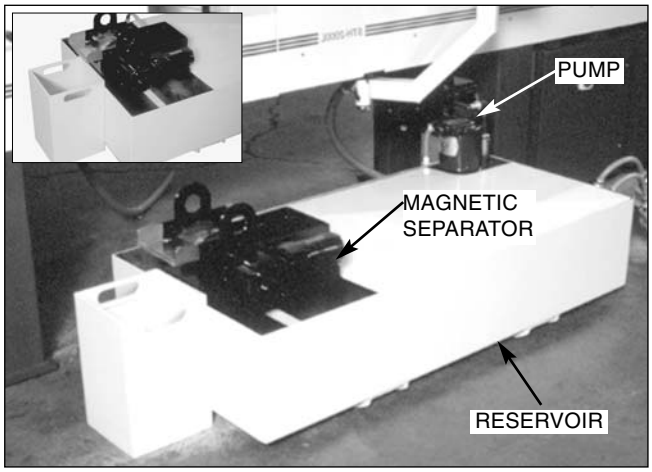


FIGURE 1-12, Coolant Reservoir

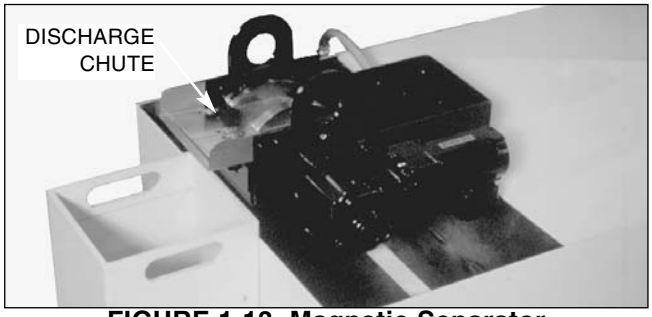


FIGURE 1-13, Magnetic Separator

CAUTION

Note model electrical supply requirement printed on machine nameplate or electrical specification plate. Do not attempt to connect machine if supply voltage is not following acceptable limits as noted on nameplate or electrical specification plate. If supply voltage is not within these limits MACHINE WILL BE DAMAGED.

Verify supply voltage is same as voltage on Machine Nameplate or Electrical Specifications Plate.

ELECTRICAL CONNECTION

A pre-drilled hole has been provided in Electrical Enclosure for Electrical Supply Cord (*not supplied*). Connect Cord as follows (see Figure 1-11).

NOTE: For Cord dimensions refer to General Information & Specification at front of this manual.

CAUTION

Doors are equipped with lockable Safety Door Latches. Doors should be closed and latched during operation to prevent accidental interruption of operation from doors being opened. Doors Latches should be Locked-Out and Tagged during servicing to prevent machine from being powered up.

1. If applicable: Loosen Safety Latches on door(s) to enclosure, using a screwdriver. Or, on CE models, unlock doors to Electrical Control Enclosure using key supplied with machine. Door(s) to enclosure is equipped with Key-Lock Safety Latches.

WARNING

Residual Voltage exists for 2-3 minutes after Master ON/OFF Switch is turned OFF. Before working inside Enclosure, wait for all fans to stop running to allow drives to discharge.

2. Turn Master ON/OFF Switch to OFF position and open Doors. (Doors WILL NOT open unless Master ON/OFF Switch is in OFF position.)

WARNING

You must use hole provided. Drilling any new holes in electrical enclosure may void machine warranty.

3. Remove hole plug from entrance hole in enclosure and install an approved oil tight fitting (not supplied).

4. Insert Electrical Supply Cord through Oil Tight Fitting and route to Electrical Disconnect Block. Allow for approximately 305 mm of cable from where it enters Enclosure; then cut off excess.

5. Strip 153 mm (6 in.) off cable's outer jacket.

6. Strip 6 mm (1/4 in.) of insulation off each wire.

7. Connect Green Wire (GRN) to Ground Terminal beside Electrical Disconnect Block (Earth Ground).

8. Connect other three wires to Disconnect Block (CB1) as noted on Block (L1, L2, L3).

9. Route and secure Cord inside of Enclosure.

10. Tighten Oil Tight Fitting.

11. Close and secure/lock Door(s) to Enclosure.

12. Route and connect Electrical Supply Cord to power source. (PLUG Machine's Electrical Supply Cord into a properly polarized grounding-type wall receptacle.)

13. Turn ON Master ON/OFF Switch.

COOLANT RESERVOIR

Maximum capacity of Coolant Reservoir is 235 Liters (62 gal.) subsequent to running Coolant pump (see Figure 1-12).

Minimum capacity of Coolant Reservoir, for proper pump operation is 110 Liters.

MAGNETIC SEPARATOR

Consult installation Instructions packaged with Magnetic Separator (see Figure 1-13)

SPECIAL FIXTURE (Optional)

Special fixturing is available for OD above 370 mm (13.8 in.). Refer to Appendix I.

OPERATIONAL CHECK

Read Sections 1 and 2 thoroughly and carefully before performing the Operational Check.

1. Operate Machine and check rotation of Spindle Shaft. Rotation of Shaft should be counterclockwise, as viewed from output end of Spindle Drive Motor. If rotation is incorrect, reverse any two wires (red, white, or black) of electrical supply cord, where they connect to Disconnect Block.

2. Operate Machine and check rotation of optional equipment according to Installation Instruction package with optional equipment.

3. Set up and test all machine functions (refer to Section 3).

4. After unpacking and installing Machine, clean and lubricate (refer to Section: 4, Routine Maintenance).

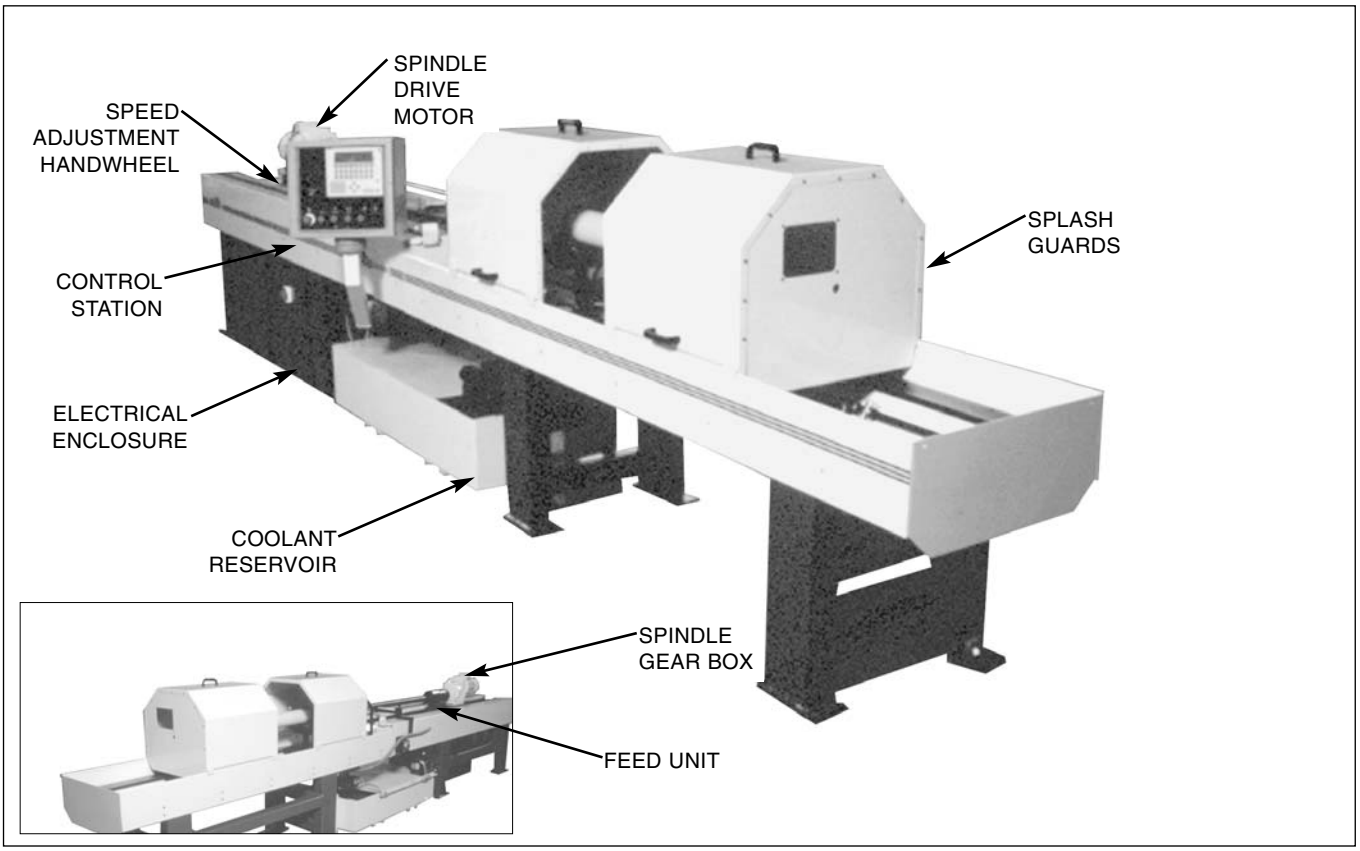


FIGURE 2-1, Major Components

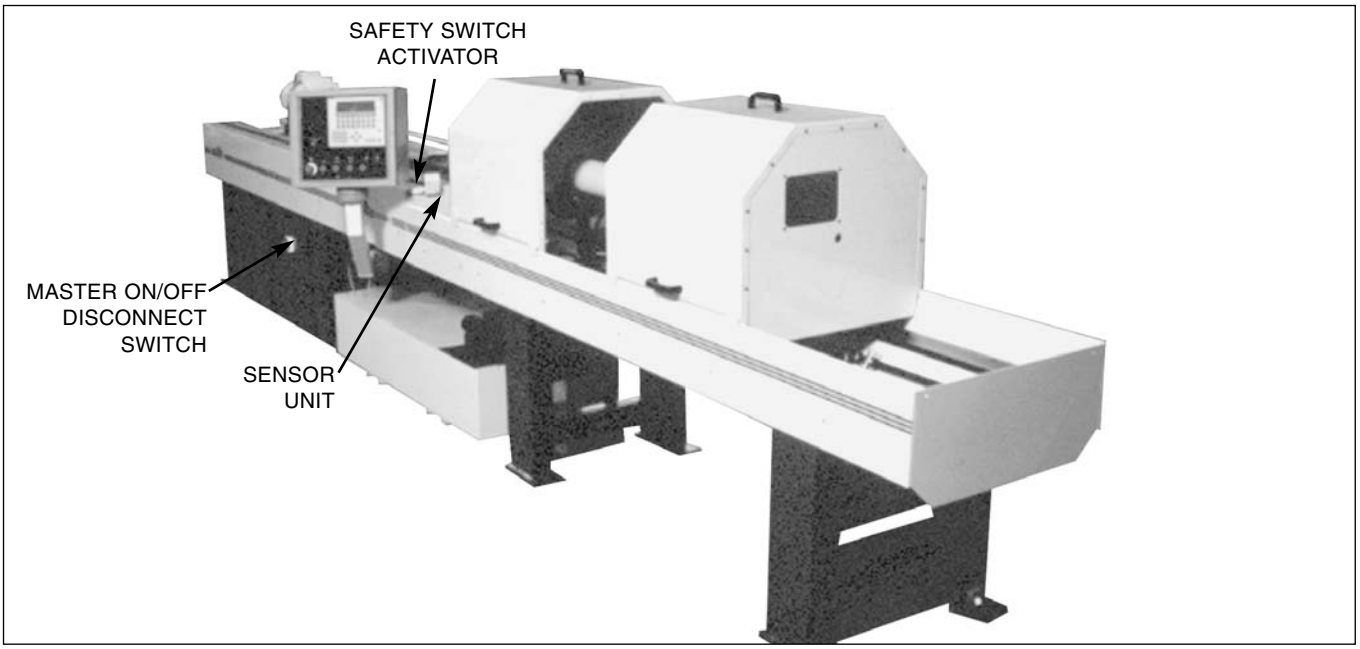


FIGURE 2-2, Emergency Switches

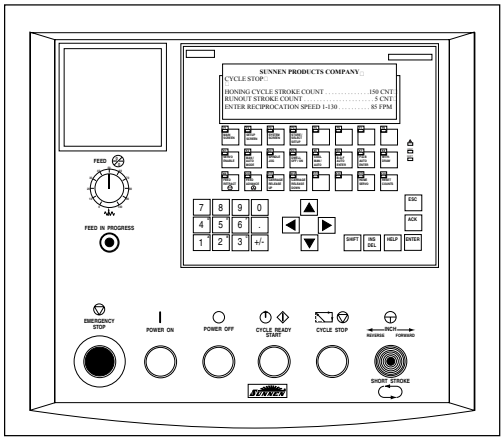
SECTION 2
PREPARING FOR OPERATION

GENERAL
Consult this section when preparing Machine for operation.

MAJOR COMPONENTS
For location of major components on machine (see Figure 2-1).

EMERGENCY SWITCHES
For location of major all electrical Emergency Switches on machine (see Figure 2-2).

CONTROLS
For location of controls see Figure 2-3; and refer to Table 2-1 thru 2-2 for function of controls.



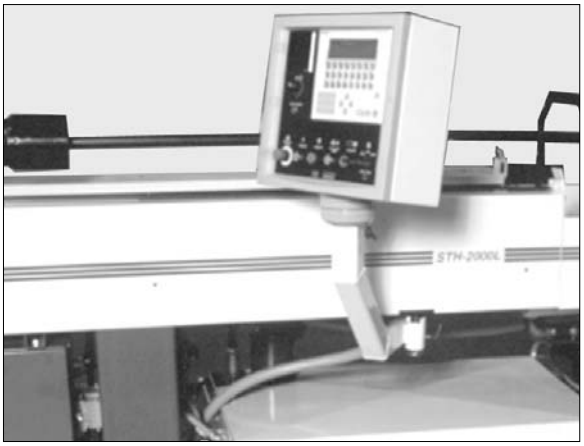


FIGURE 2-3, Control Station

TABLE 2-1, Operator Controls (Buttons & Switches)

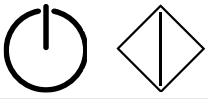
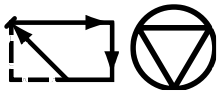
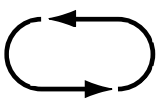
SYMBOL	DESCRIPTION	FUNCTION
	EMERGENCY STOP (Red) Pushbutton	Shuts-OFF all power to the machine functions. Button must release, before Power ON button can be pushed.
	POWER ON (Green) Pushbutton	Turns ON control power to the machine. After E-Stop Button is pushed; Power ON button must be pushed once to reset E-Stop Relay and again to turn ON Control Power.
	POWER OFF (Red) Pushbutton	Shuts-OFF control power to the machine.
	CYCLE READY START (Green) Pushbutton	Starts honing cycle. Flashes when conditions have been met to start a honing cycle.
	CYCLE STOP (Red) Pushbutton	Stops honing cycle. All counters hold their count and cycle can be resumed at place where cycle was interrupted.
	INCH 3-Way Joystick	Man. Mode: Used to move spindle carriage in either direction. Movement begins at pre-set Inch Creep Speed; after 3 sec. increases to pre-set Inch Reverse./Forward Speed.
	REVERSE FORWARD SHORT STROKE 3-Way Joystick	Auto Mode: Used to reverse direction of spindle carriage. To Short Stroke tool at either end of bore or anywhere in workpiece used joystick to hold or reverse direction of travel.
	FEED Selector Switch	

TABLE 2-2, Operator Controls (Buttons & Switches)

SYMBOL	DESCRIPTION	FUNCTION
NO SYMBOL	F1 MAIN SCREEN Touch Button	Press to access MAIN SCREEN.
NO SYMBOL	F2 SETUP SCREEN Touch Button	Press to access SETUP SCREEN.
NO SYMBOL	F3 SYSTEM SCREEN Touch Button	Press to access SYSTEM SCREEN.
NO SYMBOL	F4 STORE/SELECT SETUP Touch Button	Press to access STORE / SELECT SETUP SCREEN.
NO SYMBOL	F5 Touch Button	Various functions - Screen Dependent.
NO SYMBOL	F6 Touch Button	Various functions - Screen Dependent.
NO SYMBOL	F7 Touch Button	Various functions - Screen Dependent.
NO SYMBOL	F8 Touch Button	Various functions - Screen Dependent.
NO SYMBOL	K1 SERVO ENABLE Touch Button	Press to enable Stroke/Reciprocation Drive Servo Control.
NO SYMBOL	K2 MAN/AUTO MODE Touch Button	Press to select Operating Mode. Manual: Use inch joystick to move spindle carriage. Required to initiate “home servo.” Auto: Required to initiate “cycle start.”
NO SYMBOL	K3 SPINDLE JOG Touch Button	Press to initiate spindle for short intervals.
NO SYMBOL	K4 DWELL OFF/ON Touch Button	Press to initiate dwell status of Stroke/Reciprocation. Used in conjunction with Dwell Time and Dwell Position programming on Setup Screen
NO SYMBOL	K5 COOL MAN/AUTO Touch Button	Press to select operation of coolant pump. Manual: Coolant flows continuously. Auto: Coolant flows only during honing cycle.
NO SYMBOL	K6 B-G-F AUTO ENTER Touch Button	Press to automatically enter the current Stroke/Reciprocation Position as the Back-Go-Forward reversal set point.
NO SYMBOL	K7 F-G-B AUTO ENTER Touch Button	Press to automatically enter the current Stroke/Reciprocation Position as the Forward-Go-Back reversal set point.
NO SYMBOL	K8 WITHDRAW Touch Button	Press to interrupt honing cycle and stroke counter. Ends honing cycle. Resets all timers and counters.
	K9 FEED RETRACT Touch Button	Press to manually feed stones IN (retract/collapse).

TABLE 2-2, Operator Controls (Buttons & Switches)

SYMBOL	DESCRIPTION	FUNCTION
	K10 FEED ADVANCE Touch Button	Press to manually feed stones OUT (expand).
NO SYMBOL	K11 CARRIAGE RELEASE UP Touch Button	Press to ENGAGE Spindle Carriage Lock.
NO SYMBOL	K12 CARRIAGE RELEASE DOWN Touch Button	Press to DISENGAGE Spindle Carriage Lock.
NO SYMBOL	K13 Touch Button	NOT USED
NO SYMBOL	K14 AUTO SHORT STROKE Touch Button	Press to initiate AUTO SHORT STROKE. Used in conjunction with Auto Short Stroke Time & Position progamming on setup screen.
NO SYMBOL	K15 HOME SERVO Touch Button	Press to automatically move Spindle Carriage to Home Position and Recalibrate Servo Counter.
NO SYMBOL	K16 RESET TIME/COUNT Touch Button	Press to reset Honing Cycle Time and Runout Stroke Counter.
NO SYMBOL	SHIFT Touch Button	Used in conjunction with Numeric (Alpha) Keypad to switch to enter letters. Because of limited space, if letter is not shown, press last letter shown and use arrows to select letter.
NO SYMBOL	INS DEL Touch Button	
NO SYMBOL	HELP Touch Button	Button will light when operator entry screen for which there is a help screen. Pressing button will take operator to help screen. Press ESC button to return to previous screen.
NO SYMBOL	ENTER Touch Button	Pressing this button enters operations and entries that require this function.
NO SYMBOL	ACK Touch Button	If an alarm appears on screen then operator presses this button acknowledge alarm and return to operations screen. Red light will remain lit until condition is cleared.
NO SYMBOL	ESC Touch Button	Escape: Press to return to previous screen or step.
NO SYMBOL	FEED IN PROGRESS LED	Indicates tool is feeding. (Also see K9 and K10 Buttons.)
NO SYMBOL	SHIFT LED	Indicates that Shift Button has been pressed. (See Shift Button.)
NO SYMBOL	HELP LED	Indicates that help screen is available for present screen. (See Help Button.)
NO SYMBOL	(CAUTION) LED	Indicates that an alarm has sounded. (See ACK Button.)
NO SYMBOL	CURSOR KEYS	Arrows: Used in conjunction with other keys/buttons. Used to move cursor on display screen.
NO SYMBOL	NUMERIC (ALPHA) KEYPAD	Used to enter numbers. Using Shaft Button allows operator to enter letters. Press last letter and use up arrow to scroll to desired letter and press enter.

TABLE 2-3, Safety Symbols

SYMBOL	DESCRIPTION	FUNCTION
	Warning Label	Warns that an electrical hazard exists.
	Warning Label	Warns that safety glasses should be worn at all times when operating this machine.
	Warning Strip	Warns that a *physical hazard exists*, and that proper precautions should be taken.
	Label	Designates this machine is *"CE" compliance*.
	Warning Label	Warns that a *hazard from objects falling off work table* exists and that proper precautions should be taken.
	Warning Label	Warns not to hold workpiece in hand without a torque resisting fixture.

SAFETY SYMBOLS

For a description of safety symbols that may be used on this machine refer to Table 2-3.

WORKHOLDING FIXTURE

Position the Workholding Fixture as follows:

1. Loosen four Socket Head Capscrews in base of Workholding Fixtures and Screw in Collar Clamps, use 10 mm Hex Wrench (see Figure 2-4).

2. Position Fixture so Workpiece will be clamped close to its Ends (approx. 400 mm).

NOTE: Column Base is shown in its Normal Position. If OD of Workpiece is below ø75 mm, mount Column Base in upside-down position.

---

3. Measure distance between Slot and Bottom line of Column Base.

4. Adjust height of Workholding Fixture by turning Adjusting Nut (see Figure 2-4 & Table 2-4).
The Workholding Fixture should be adjusted so centerline of Workpiece is approximately in line with Spindle Axis.

5. Lay Securing Chain out of Fixture.

6. Lift Workpiece into Machine, using a hoist as required.

7. Align Workpiece with Fixtures. Position Fixtures as required. Workpiece should be clamped between 300-500 mm from its Ends for best Results.

8. Lower Workpiece into place on Fixture.

9. Wrap Securing Chain around Workpiece and engage in Catch.

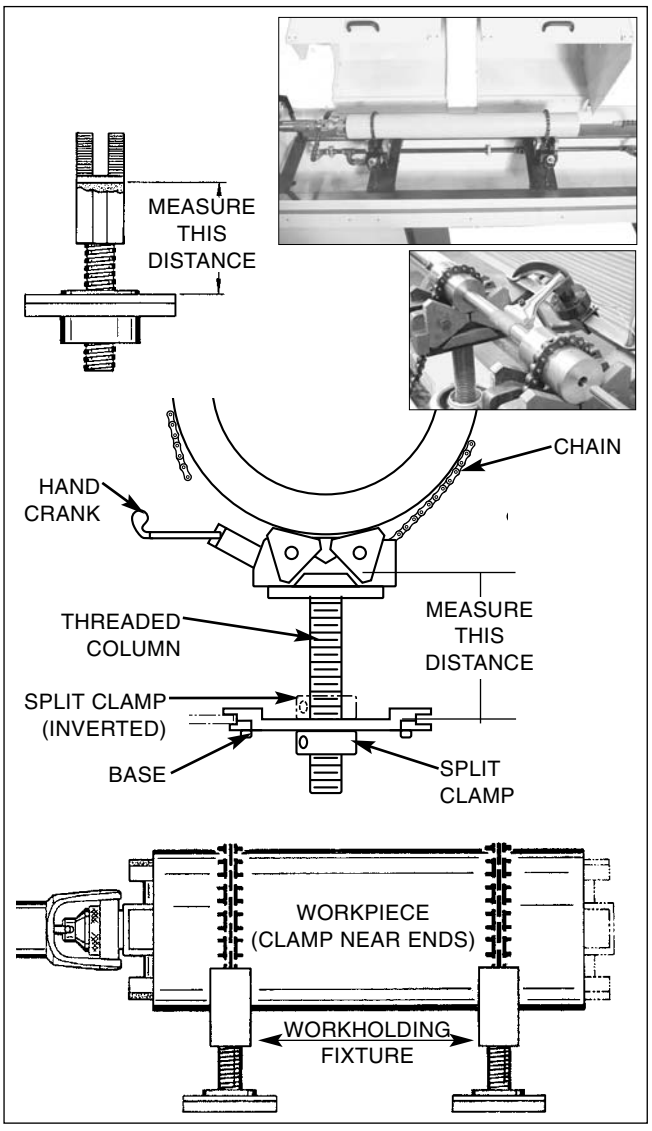


FIGURE 2-4, Fixture

TABLE 2-4, Fixture Height Adjustment

L-SERIES

	INVERTED POSITION					MILLIMETERS				NORMAL POSITION						
+mm	30	60	90	120	150	60	90	120	150	180	210	240	270	300	330	360
0	265	248	231	214	199	--	207	189	173	153	135	119	103	87	71	56
3	263	246	229	212	198	--	206	187	171	151	133	117	101	86	70	54
6	261	244	228	211	196	--	204	185	169	149	131	115	99	84	68	52
9	260	242	226	209	195	--	203	183	167	147	130	114	98	83	67	51
12	258	241	224	208	193	--	201	181	165	146	128	113	97	81	65	49
15	257	239	222	206	192	215	198	179	163	144	127	112	96	80	64	--
18	255	237	220	204	190	214	196	178	161	142	125	110	94	78	62	--
21	253	236	218	202	188	212	194	177	159	140	124	108	92	76	60	--
24	252	234	216	201	187	210	192	176	157	139	122	106	90	74	58	--
27	250	233	215	200	186	209	190	175	155	137	121	105	89	73	57	--

	INVERTED POSITION					INCHES				NORMAL POSITION						
+ in.	1.2	2.3	3.5	4.7	5.9	2.4	3.5	4.7	5.9	7.1	8.3	9.5	10.6	11.8	13.0	14.2
0.0	10.4	9.8	9.1	8.4	7.8	--	8.1	7.4	6.8	6.0	5.3	4.7	4.1	3.4	2.8	2.2
0.1	10.4	9.7	9.0	8.3	7.8	--	8.1	7.4	6.7	5.9	5.2	4.6	4.0	3.4	2.8	2.1
0.2	10.3	9.6	9.0	8.3	7.7	--	8.0	7.3	6.7	5.9	5.2	4.5	3.9	3.3	2.7	2.0
0.4	10.2	9.5	8.9	8.2	7.7	--	8.0	7.2	6.6	5.8	5.1	4.5	3.9	3.3	2.6	2.0
0.5	10.2	9.5	8.8	8.2	7.6	--	7.9	7.1	6.5	5.7	5.0	4.4	3.8	3.2	2.6	1.9
0.6	10.1	9.4	8.7	8.1	7.6	8.5	7.8	7.0	6.4	5.7	5.0	4.4	3.8	3.1	2.5	--
0.7	10.0	9.3	8.7	8.0	7.5	8.4	7.7	7.0	6.3	5.6	4.9	4.3	3.7	3.1	2.4	--
0.8	10.0	9.3	8.6	8.0	7.4	8.3	7.6	7.0	6.3	5.5	4.9	4.3	3.6	3.0	2.4	--
0.9	9.9	9.2	8.5	7.9	7.4	8.3	7.6	6.9	6.2	5.5	4.8	4.2	3.5	2.9	2.3	--
1.1	9.8	9.2	8.5	7.9	7.3	8.2	7.5	6.9	6.1	5.4	4.8	4.1	3.5	2.9	2.2	--

NOTE: Out Side Diameter is in MILLIMETERS / INCHES

HOW TO USE FIXTURE HEIGHT CHART

Find Workpiece O.D. by reading across the top and down the left side of the chart. Where the column and line intersect is the approximate height at which the fixture should be set.

EXAMPLE: *OD of Workpiece is 165 mm*

Find column 150 mm on top of chart, move down the column until it intersects line 15. For this example the Fixture should be set at 192 mm.

H-SERIES

	INVERTED POSITION					MILLIMETERS				NORMAL POSITION						
+mm	30	60	90	120	150	60	90	120	150	180	210	240	270	300	330	360
0	--	262	245	228	213	--	221	203	187	167	149	133	117	101	85	70
3	--	260	243	226	212	--	220	201	185	165	147	131	115	100	84	68
6	--	258	242	225	210	--	218	199	183	163	145	129	113	98	82	66
9	--	256	240	223	209	--	217	197	181	161	144	128	112	97	81	65
12	--	255	238	222	207	--	215	195	179	160	142	127	111	95	79	63
15	--	253	236	220	206	229	212	193	177	158	141	126	110	94	78	--
18	--	251	234	218	204	228	210	192	175	156	139	124	108	92	76	--
21	--	250	232	216	202	226	208	191	173	154	138	122	106	90	74	--
24	--	248	230	215	201	224	206	190	171	153	136	120	104	88	72	--
27	--	247	229	214	200	223	204	189	169	151	135	119	103	87	71	--

	INVERTED POSITION					INCHES				NORMAL POSITION						
+ in.	1.2	2.3	3.5	4.7	5.9	2.4	3.5	4.7	5.9	7.1	8.3	9.5	10.6	11.8	13.0	14.2
0.0	--	10.3	9.6	9.0	8.4	--	8.7	8.0	7.4	6.6	5.9	5.2	4.6	4.0	3.3	2.8
0.1	--	10.2	9.6	8.9	8.3	--	8.7	7.9	7.3	6.5	5.8	5.2	4.5	3.9	3.3	2.7
0.2	--	10.2	9.5	8.9	8.3	--	8.6	7.8	7.2	6.4	5.7	5.1	4.4	3.9	3.2	2.6
0.4	--	10.1	9.4	8.8	8.2	--	8.5	7.8	7.1	6.3	5.7	5.0	4.4	3.8	3.2	2.6
0.5	--	10.0	9.4	8.7	8.1	--	8.5	7.7	7.0	6.3	5.6	5.0	4.4	3.7	3.1	2.5
0.6	--	10.0	9.3	8.7	8.1	9.0	8.3	7.6	7.0	6.2	5.6	5.0	4.3	3.7	3.1	--
0.7	--	9.9	9.2	8.6	8.0	9.0	8.3	7.6	6.9	6.1	5.5	4.9	4.3	3.6	3.0	--
0.8	--	9.8	9.1	8.5	8.0	8.9	8.2	7.5	6.8	6.1	5.4	4.8	4.2	3.5	2.9	--
0.9	--	9.8	9.1	8.5	7.9	8.8	8.1	7.5	6.7	6.0	5.4	4.7	4.1	3.5	2.8	--
1.1	--	9.7	9.0	8.4	7.9	8.8	8.0	7.4	6.7	5.9	5.3	4.7	4.1	3.4	2.8	--

NOTE: Out Side Diameter is in MILLIMETERS / INCHES

10. Adjust tension on Securing Chain by turning Hand Crank. Hand tightens to approximately 40-50 Newton meters.

11. Tighten four Capscrews in base of each Workholding Fixture, and Collar Clamp Screws, loosened in step 1 (refer to Figure 2-4).

HONING TOOL

Assembly and install Honing Tool per instructions packaged with Tooling.

1. Assemble Honing Tool (see Figure 2-5).

2. Press K12-Carriage Release Down-Button and slide Spindle Carriage to the left (see Figure 2-6).

NOTE: The Spindle Retractor Carriage provides 380 mm of tool withdrawal motion.

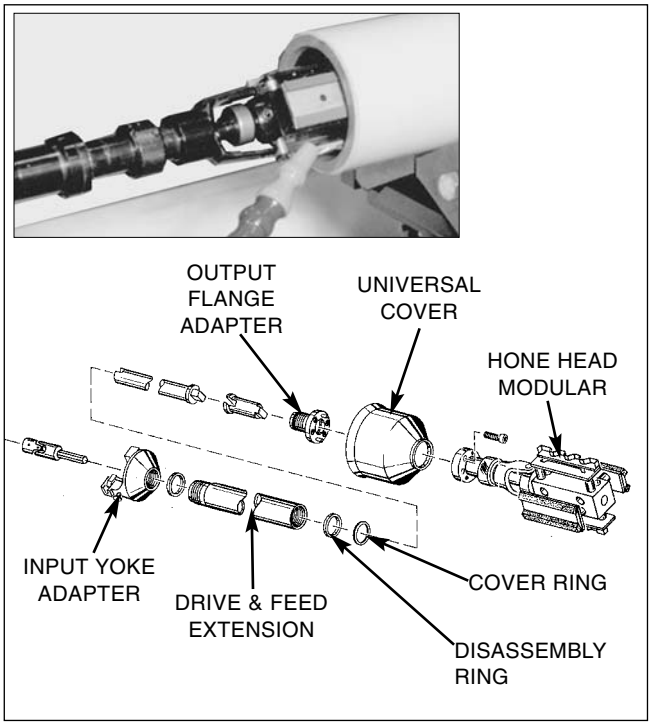


FIGURE 2-5, Honing Tool

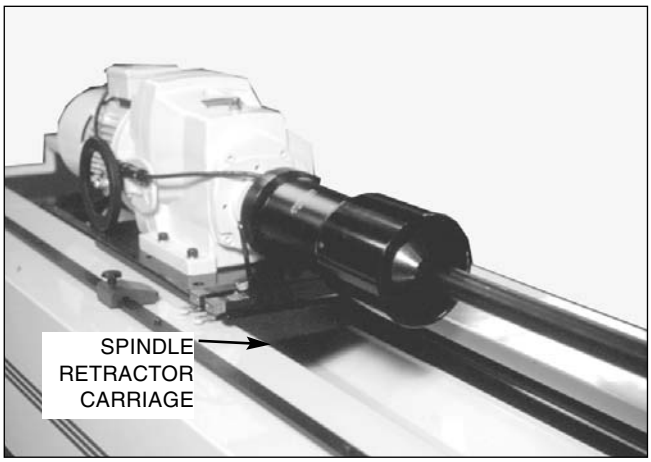


FIGURE 2-6, Spindle Retractor Carriage

3. Swing Tool Support Bar into load position and tighten Adjustment Handle. Adjust height by loosening Collar Clamp and raising or lowering as required (see Figure 2-7).

4. Rest Honing Tool on Tool Support Bar.

5. Align Input Yoke Adapter on Honing Tool with Drive Ring, and guide adapter onto Hex Shaft (see Figure 2-8).

6. Rotate input Yoke Adapter (clockwise) to engage and Lock into Drive Ring on Spindle Nose.

7. If supplied: Slide Universal Cover over Input Yoke Adapter.

8. Guide Honing Tool into bore by sliding Spindle Carriage to right. Press K11-Carriage Release Up-Button to lock spindle carriage into normal operating position.

9. Loosen Adjustment Handle and swing Tool Support Bar into operating position. Tighten Adjustment Handle.

WARNING

Do not operate Machine with Tool Support Bar in load position!

SPINDLE CARRIAGE

Spindle Retractor Carriage allows Honing Tool to be withdrawn from Workpiece for gaging, stone set replacement or installing a new Workpiece, without removing tool or changing any of the settings.

NOTE: The Spindle Retractor Carriage provides 380 mm of tool withdrawal motion.

1. After honing cycle is completed, retract stones slightly by pressing K9-Feed Retract-Button (see Figure 2-9).

2. Swing Tool Support Bar into load position and tighten Adjustment Handle. Adjust height by loosening Collar Clamp and rising or lowering as required.

3. Press K12-Carriage Release Down-Button and slide Spindle Carriage to the left.

4. Perform required operation. Guide Hone Head Module into bore by sliding Spindle Carriage to right and press K11-Carriage Release Up-Button to lock in place.

WARNING

Do not hone with Tool Support Bar in load position; Honing Tool may catch on Bar and cause personal injury and/or Machine damage.

5. Loosen Adjustment Handle and swing Tool Support Bar back from load position. Tighten Adjustment Handle.

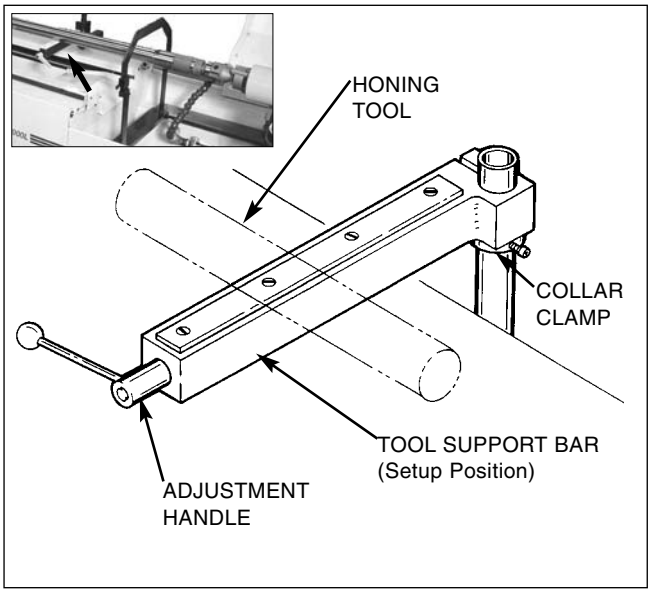


FIGURE 2-7, Tool Support

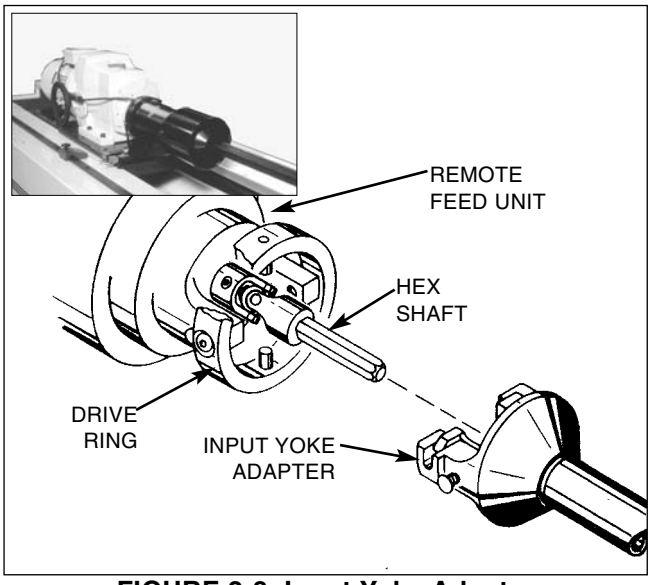


FIGURE 2-8, Input Yoke Adapter

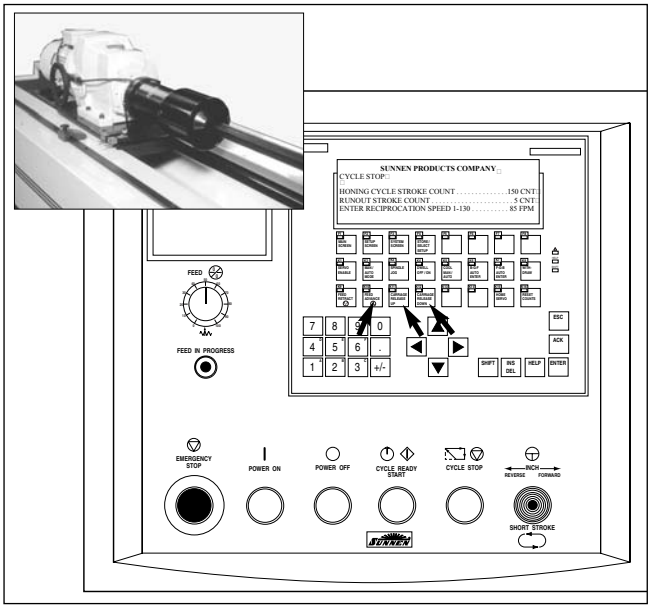


FIGURE 2-9, Spindle Retractor Carriage

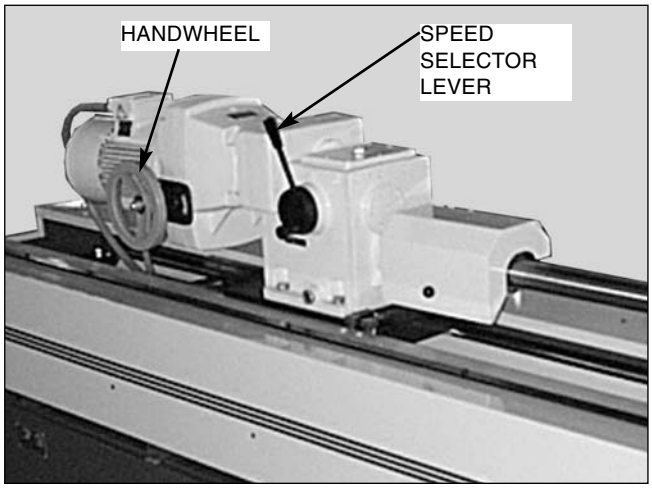


FIGURE 2-10, Spindle Drive (Optional)

SPINDLE CARRIAGE (Optional)

The Spindle Retractor Carriage allows the Honing Tool to be withdrawn from the Workpiece for gaging, stone set replacement or installing a new Workpiece, without removing tool or changing any of the settings. (Refer to Section 3 and Table 3-2 for setting Spindle Speed.)

NOTE: The Spindle Retractor Carriage provides 380mm of tool withdrawal motion.

1. After honing cycle is completed, retract stones by switching RAPID FEED RETRACT Switch.

2. Swing Tool Support Bar into load position and tighten Adjustment Handle. Adjust height by loosening Collar Clamp and rising or lowering as required.

3. Press UNLOCK-CARRIAGE Button and slide carriage to the left.

4. Perform required operation.

Guide Hone Head Module into the bore by sliding Spindle Retractor Carriage to the right until Carriage Release Locks in place.

WARNING

Do not hone with Tool Support Bar in load position; Honing Tool may catch on Bar and cause personal injury and/or Machine damage.

5. Loosen Adjustment Handle and swing Tool Support Bar back from load position. Tighten Adjustment Handle.

NOTES

SECTION 3
SETUP & OPERATION

GENERAL

This section describes a step-by-step operating procedure for Machine.

• Prior to starting Machine, Operator shall ensure:

• All prerequisites described in sections 1 and 2 are complete.

• All personnel are clear of machine.

SAFETY PRECAUTIONS

The following precautions should be followed to ensure maximum safety of personnel while working on or around Machine.

• DO NOT operate machine while lifting devices are installed.

• Ensure workpiece is securely fixtured and located before operating.

• Ensure all guards are in place before operating.

• Ensure area is clear of other personnel before operating machine.

• Keep machine clear of tools or other foreign objects.

• Wear proper safety items such as, safety glasses, gloves, non-slip safety shoes and other personal safety equipment as necessary or required.

• DO NOT wear loose clothing or jewelry while working on or around machine.

• Keep area around machine free of paper, oil, water and all other debris at all times.

• When lifting part or tooling use proper lifting procedures. DO NOT overreach; keep proper footing and balance at all times.

• CE Push E-STOP Button and turn OFF electrical power at Disconnect Switch, on Electrical Enclosure when preforming service not requiring power.

• CE Turn OFF electrical power at Main Power Source when preforming maintenance on, or cleaning of Electrical Control Enclosure.

• Clear area of excessive lubricant or lubricant spills.

• DO NOT adjust stroke length while Spindle Retractor Carriage is not in locked position.

• KEEP hands clear of all moving parts. Stay clear of all moving parts.

• Remove keys and wrenches from machine before honing.

• DO NOT operate machine with tool support bar in load position.

• To avoid personal injury, allow spindle and stroking arm to come to a complete stop before removing part.

• Keep all visitors a safe distance from work area.

• DO NOT use in dangerous environment. DO NOT use machines in damp or wet locations, or expose them to rain. Keep work area well lighted.

• IT IS DANGEROUS to rotating parts, such as, drive shafts and honing tool during operation.

OPERATING HINTS

There are several features on the STH Machines for correcting problems in the bore. These features are as follows:

1. During honing cycle, the Short Stroke Joystick can be used at any time to reduce “Tight Spots”.

2. Additionally, the Short Stroke Joystick can be used to stop or oscillate the stroke at either end of the bore, for correcting barrel or bellmouth conditions.

3. Ability to dwell at either or both ends.

4. Auto short stroke at blind end of bore. Opens up blind end, then goes into regular cycle.

SETUP & OPERATION

1. Assemble and install Honing Tool (refer to Section 2).

2. Turn ON power at Main Power Disconnect Switch, on Electrical Enclosure.

3. Release all Emergency STOP Buttons. Also insure Carriage is in locked position.

4. Press Power ON Button. If Main Power has been cycled, press Power ON Button twice.

NOTE: Machine automatically comes up in Manual Mode when power is turned ON.

---

5. Press ACK Button to acknowledge message: “Re-Zero Machine - Re-Home Servo.”

6. Press K1, Servo Enable Button on Control Panel.

7. If required: Press K2, Manual/Auto Mode Button until LED is OFF.

8. Press K15, Home Servo Button.

9. If not connected: Hold JOYSTICK in Inch Forward direction, to move carriage far enough to the right so Honing Tool can be connected.

10. Press K10, Feed Advance Button to expand stone in workpiece bore; hold until all stones contact bore wall. Shaking Honing Tool keeps hone from binding in bore while stones are being fed out.

WARNING

Do not operate Machine with Tool Support Bar in load position!

11. Loosen Adjustment Handle and swing Tool Support Bar into operating position. Tighten Adjustment Handle.

12. Retract stones slightly by pressing K9, Feed Retract Button. (Starting hone with stones pressed tightly against bore wall produce unnecessary stone wear).

13. Use JOYSTICK to move Honing Tool to left end of Workpiece, then run Tool approximately 1/3 of Stone length out of Workpiece to allow for overstroke. (Back-Go-Forward Reciprocation Reversal Position.)

14. Press F2, Setup Screen Button.

15. Press.K6, B-G-F Auto Enter Button.

16. Set Left SAFETY SWITCH ACTIVATOR 12 mm (1/2 in.) from Limit Switch Arm.

17. Use JOYSTICK to move Honing Tool to right end of Workpiece, then run Tool approximately 1/3 of Stone length out of Workpiece to allow for overstroke. (Forward-Go-Back Reciprocation Reversal Position.)

18. Press K7, F-G-B Auto Enter Button.

19. Set Right SAFETY SWITCH ACTIVATOR 12 mm (1/2 in.) from Limit Switch Arm.

20. Cursor down to highlight Enter Honing Cycle Time: Enter desired time (minutes & seconds) and press ENTER.

21. Cursor down to highlight Enter Run Out Stroke Count: Using Keypad enter desired number of Run Out Strokes to be completed during Run Out Cycle and press ENTER.

22. Cursor down to highlight Dwell Time: Using Keypad enter Dwell Time (Forward & Back)(sec.) and press ENTER.

23. Press F7 to select desired Dwell Location. (Forward, Back, or Both.)

24. Cursor down to highlight Manual Short Stroke (Forward) Distance: Using Keypad enter distance (inches/millimeters) and press ENTER.

25. Cursor down to highlight Manual Short Stroke (Back) Distance: Using Keypad enter distance (inches/millimeters) and press ENTER.

26. Cursor down to highlight Auto Short Stroke (Forward) Distance: Using Keypad enter distance (inches/millimeters) and press ENTER.

27. Cursor down to highlight Auto Short Stroke Time: Using Keypad enter Stroke Time (sec.) and press ENTER.

TABLE 3-1, Spindle Speed (Standard)

SPINDLE-SPEED IN RPM					
ø in mm	RPM	ø in mm	RPM	ø in mm	RPM
under 40	430	155	113	360	48
45	388	160	110	380	46
50	350	165	106	400	44
55	318	170	103	425	41
60	292	175	100	450	39
65	270	180	97	475	37
70	250	185	95	500	35
75	233	190	92	525	33
80	219	195	90	550	31
85	206	200	88	575	30
90	195	210	84	600	29
100	175	220	80	625	28
105	167	230	76	650	27
110	160	240	73	675	26
115	152	250	70	700	25
120	146	260	67	725	24
125	140	270	65	750	23
130	135	280	63	800	22
135	130	290	60	850	21
140	125	300	58	900	20
145	121	320	55	950	18,5
150	117	340	51	1000	17,5

The optimum cutting Speed is about 55m/min.

$$\text{Calculate Optimum Spindle Speed} = \frac{17500}{\text{Bore Diameter (in millimeters)}} = \text{RPM}$$

TABLE 3-2, Spindle Speed (Optional)

SPINDLE-SPEED IN RPM											
ø in mm	RPM	No.	⊙	ø in mm	RPM	No.	⊙	ø in mm	RPM	No.	⊙
25-40	420	**3**	10.0	155	113	**2**	5.7	350	50.0	**1**	8.1
45	388	**3**	9.5	160	110	**2**	5.5	360	49.0	**1**	7.9
50	350	**3**	8.1	165	106	**2**	5.3	380	46.0	**1**	7.4
55	318	**3**	7.3	170	103	**2**	5.1	400	44.0	**1**	7.0
60	292	**3**	6.6	175	100	**2**	4.9	425	41.0	**1**	6.5
65	270	**3**	6.0	180	97	**2**	4.7	450	39.0	**1**	6.0
70	250	**3**	5.4	185	95	**2**	4.5	475	37.0	**1**	5.7
75	233	**3**	5.0	190	92	**2**	4.4	500	35.0	**1**	5.3
80	219	**3**	4.6	200	88	**2**	4.1	525	33.0	**1**	5.0
85	206	**3**	4.3	210	84	**2**	3.9	550	31.0	**1**	4.7
90	195	**3**	4.0	220	80	**2**	3.6	575	30.0	**1**	4.5
95	184	**3**	3.7	230	76	**2**	3.4	600	29.0	**1**	4.2
100	175	**2**	9.5	240	73	**2**	3.2	625	28.0	**1**	4.0
105	167	**2**	9.0	250	70	**2**	3.1	650	27.0	**1**	3.8
110	160	**2**	8.5	260	67	**2**	2.9	675	26.0	**1**	3.6
115	152	**2**	8.1	270	65	**2**	2.7	700	25.0	**1**	3.4
120	146	**2**	7.7	280	63	**2**	2.6	725	24.0	**1**	3.3
125	140	**2**	7.4	290	60	**2**	2.5	750	23.0	**1**	3.1
130	135	**2**	7.0	300	58	**1**	9.6	800	22.0	**1**	2.9
135	130	**2**	6.7	310	56	**1**	9.3	850	21.0	**1**	2.6
140	125	**2**	6.4	320	55	**1**	9.0	900	20.0	**1**	2.4
145	121	**2**	6.2	330	53	**1**	8.7	950	18.5	**1**	2.2
150	117	**2**	5.9	340	51	**1**	8.4	1000	17.5	**1**	2.0

CALCULATION

Spindle Speed 12 - 58 + RPM x 70 - 466.668 : 373,332 = **1**

Spindle Speed 58 - 176 + RPM x 22.95 - 466.668 : 373,332 = **2**

Spindle Speed 176 - 420 + RPM x 10 - 466.668 : 373,332 = **3**

The optimum cutting Speed is about 55m/min.

$$\text{Calculate Optimum Spindle Speed} = \frac{17500}{\text{Bore Diameter (in millimeters)}} = \text{RPM}$$

TABLE 3-3, Feed Rate

DIAMETER mm	DIAMETER in.	SPINDLE SPEED RPM	FEED SETTING % ROUGH[1]	FEED SETTING % FINISH[2]
50	2	350	10%	30%
75	3	230	10%	40%
100	4	175	20%	50%
125	5	140	20%	60%
200	8	88	20%	70%
305	12	58	20%	75%
380	15	46	20%	75%

FOR FASTER STOCK REMOVAL INCREASE FEED.

IF STONES WEAR RAPIDLY:

- Reduce Feed Rate
- Use Harder Stones

[1] Always use this setting during the first few (roughing) strokes.

[2] For finishing use Feed Setting of 15% to 20%.

28. If desired: Press F8 Button, to release Spindle Brake.

29. Press F3, System Screen Button.

30. Press F5, Load Meter Sensitivity. *(Available on L-Series ONLY.)* This is an adjustqable parameter. This represents Max HP Limit at 100% as displayed by Load Meter. 100% Load of meter is determined from this parameter setting. Range are 4, 3, 2, & 1 HP. Adjust this parameter with repect to bore diamter, honing application (ie. stock removal, polishing, straightening), and tooling arrangement.

Example: A small dia. polishing application will require a lower HP Limit Setting. A large dia. bore. heavy stock removal application would require a higher HP setting.

Move cursor down to Auto Feed Rate. The ranage here is 1-100%. This is the rate at which feed motor expands during a honing cycle. 100% would be the fastest allowed expand rate.

Move cursor down to Jog in auto Feed Rate. The range here is 1-100%. This is the rate at whcihc the feed motor will expand when you press the rapid expand button during a honing cycle. 100% would be the Max. allowed expand rate.

31. Cursor down to highlight Enter Tool Auto Retract Time: Using Keypad enter Time (sec.) and press ENTER.

32. Use JOYSTICK to move Honing Tool to middle of Workpiece.

33. Set Spindle Speed: Using Spindle Motor Speed Adjustment Handwheel select desired Spindle RPM (see Table 3-1, or Table 3-2).

34. Disconnect Driveshaft from Spindle and slide slightly forward.

35. Install U-Joint Stabilizer onto Feed Rod Output Shaft.

36. Press F6, Calibrate Load Meter Button.

37. Follow instructions on screen and press F8 when complete.

38. Reconnect Driveshaft to Spindle (refer to step 31).

NOTE: DO NOT leave this screen until calibration is complete. If you do, you must return to this screen to complete calibration.

---

39. Press F1, Main Screen-Button.

40. Set Stroke Rate: Using Keypad enter desired Stroke Rate / Reciprocation Speed (m/min. or ft/min.) and press ENTER Key.

41. Hold JOYSTICK in the Inch Reverse direction, until Honing Tool is even with workpiece left end (end nearest Operator Control Panel).

42. Set Feed Rate: Adjust Feed Knob to lowest setting that gives good cutting action with respect to bore diameter, condition of bore, material, and stones used (see Table 3-3).

NOTE: The Feed Settings shown in Table are offered as a suggested starting point. Experiences with your particular operation will dictate the most economic feed setting for your shop.

---

43. Position Coolant Nozzle to direct oil into bore. Ensure there is enough clearance for overstroke by Honing Tool. Use ONLY one Coolant Nozzle, so metal chips may be properly flushed from workpiece during honing

44. Open Flow Control Valve on Coolant Nozzle.

45. Install and position Splash Guards.

WARNING

Do not hone with Tool Support Bar in load position; Honing Tool may catch on Bar and cause personal injury and/or Machine damage.

---

46. Loosen Adjustment Handle and swing Tool Support Bar back from load position. Tighten Adjustment Handle.

47. Recheck all values entered in Control Panel.

48. Press K2, Manual/Auto Mode Button, until LED is ON.

49. Press CYCLE READY/START Button to initiate A Honing Cycle.
Honing Tool will continue to feed stones out, to maintain load set by Feed Knob, until Honing Cycle Time reaches zero (0). At that point, the stones stop feeding out and remain in a blocked position until Run Out Stroke Counter reaches zero (0) and Honing Cycle ends.

NOTE: After Timer reaches „0", or WITHDRAW Key is pressed Machine Stops honing at end of next completed stroke. Timer automatically resets each time. Cycle Stop Button keeps remaining time.

NOTE: Pressing Red E-STOP Button will Shut OFF power to all machine functions. After E-STOP Button has been pressed: E-STOP Button must be released, POWER ON Button must be pressed twice before machine will operate. Also, K9-FEED RETRACT-Button must be used so that stones will not be under pressure before machine can be restarted. When honing cycle is interrupted Timer resets itself.

---

50. Press K2, Manual/Auto Mode Button, until LED is OFF.

51. Retract stones slightly by pressing K9, Feed Retract Button.

52. Swing Tool Support into Load Position.

53. Press K12, Carriage Release Down Button and slide spindle carriage to the left.

54. Slide Honing Tool out of Bore.

NOTES

SECTION 4
ROUTINE MAINTENANCE

GENERAL

The following procedures and suggested maintenance periods are given as guides only and are not to be construed as absolute or invariable. Local conditions must always be considered. Each machine must be maintained individually according to its particular requirements.

WARNING

Turn OFF electrical power when performing service on your machine, which does not require power. Disconnect Machine from main power supply before any work is performed inside of Electrical Enclosure.

CLEANING

Daily: Wipe exterior of Machine with a clean dry cloth.

Monthly: Wipe exterior of Machine with a clean dry cloth; Wash exterior of Machine with warm water and a mild detergent (or mild industrial solvent); Rinse thoroughly with clean hot water; Wipe dry with a clean dry cloth.

LUBRICATION

Hand lubricate various machine components called out in below.

NOTE: The intervals between lubrication will vary with amount of use your Machine receives. Lubricate all components at least once every six months.

CAUTION

Be careful not to get oil on drive belts, pulleys, or brake strap.

① SPINDLE CARRIAGE WAYS: Wipe Spindle Carriage Ways with a clean soft cloth, and lubricate with MOBIL WAY OIL 300 or its equivalent (see Figure 4-1). (EVERY THREE MONTHS)

② SPINDLE CARRIAGE LINEAR BUSHINGS: Linear Bushing Assemblies subject to normal loads may be lubricated with a lithium-base grease of a consistency class NLGI to DIN51818. The grease supply should be enough to allow the balls to recirculate smoothly, but without undue viscous resistance (refer to Figure 4-1). (3-5 CCM ONCE PER YEAR)

GEARBOXS: When Spindle Drive is not running Check lubricant level in Sight Glass on the ③ Spindle Drive Gearbox and fill as required (refer to Figure 4-1).

④ H-Series ONLY: Check lubricant level of optional Gearbox and fill as required (see Figure 4-2).

Add oil as required, according to label on Gearbox(s) (Mobilgear SHC-629). Change lubricant in Gearbox(s) every 5000 hour of operation, and fill with fresh lubricant according to label on Gearbox.

③ Capacity of Spindle Drive Gearbox is 0,75 Liters.

④ Capacity of optional Gearbox is 7.5L.

NOTE: New Spindle Drive Gearbox models without a Sight Glass and Fill Plug have Live Lubrication).

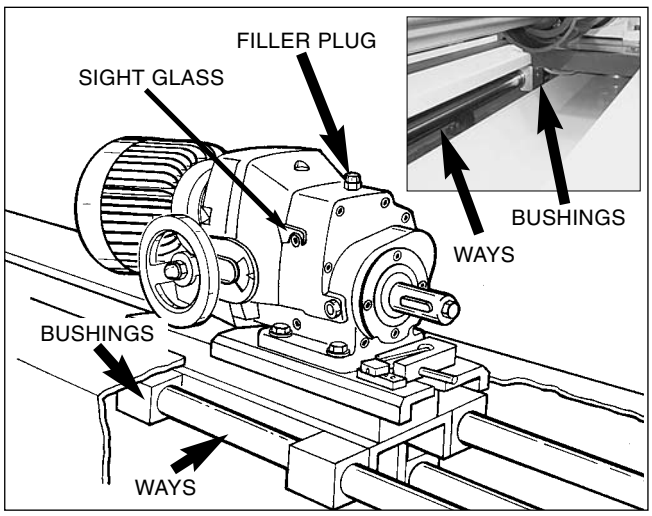


FIGURE 4-1, Spindle Carriage Ways

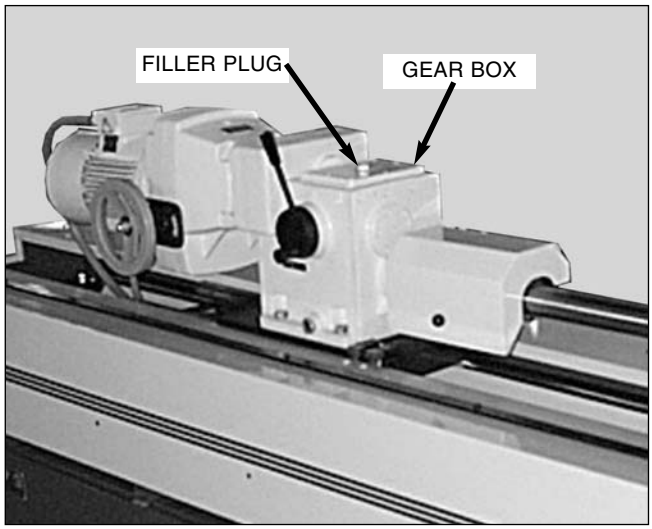


FIGURE 4-2, Gearbox (Optional)

⑤ STROKING GEARBOX: Lubricate Stroking Gearbox, located under drip pan. with approx. 450cc of Mobilgear 630 CLP ISO VG220. EVERY 10,000 HOURS (see Figure 4-3).

⑥ CHAIN: Lubricate Spindle Carriage Chain with a Chain Spray (same as Motor-Cycle) EVERY THREE MONTHS (see Figure 4-4).

CHAIN

Check Chain tension of Spindle Carriage and adjust as follows (see Figure 4-5).

1. Bring the Spindle Carriage in the middle of stroke, then move by hand forward and backward. If you feel any clearance, adjust the Chain tension of Spindle Carriage by the following operations.

2. Press E-STOP.

3. Loosen Screw in Top of Chain Adjuster approx. ½ Turn.

4. Loosen both Nuts of Chain Adjuster.

5. Pull back the Chain Adjuster by hand and tighten first nut by hand.

6. Then tighten first Nut with a 46 mm Open End Wrench ... Turn and tighten second Nut.
STH 2000 = 1¼ Turn, STH 4000 = 1¾ Turns
STH 6000 = 2¼ Turn, STH 8000 = 2¾ Turns

7. Tighten the Screw in Top of Chain Adjuster.

COOLANT RESERVOIR

Clean Coolant Reservoir and Replace Coolant as follows (see Figure 4-6):

1. Direct one or more Coolant Nozzles into an approved waste container.

2. Open Coolant Control Valves.

3. Press K5, Cool Man/Auto Button, turn pump ON and pump waste Coolant into waste container.

4. As Coolant flow drops off, press E-Stop Button.

5. Close Coolant Control Valves.

6. Disconnect Coolant Reservoir Plug from Connecting Panel.

7. Remove Drain Tube and disconnect oil fitting, then slide Reservoir out from Machine.

8. Take out Magnetic Filter from Reservoir.

9. To remove Coolant that was not pumped out by Pump, remove Drain Plug on front of Reservoir

10. Drain and clean Reservoir.

11. Slide Reservoir under Machine

12. Connect oil fitting, then install Drain Tube and connect Coolant Reservoir Plug.

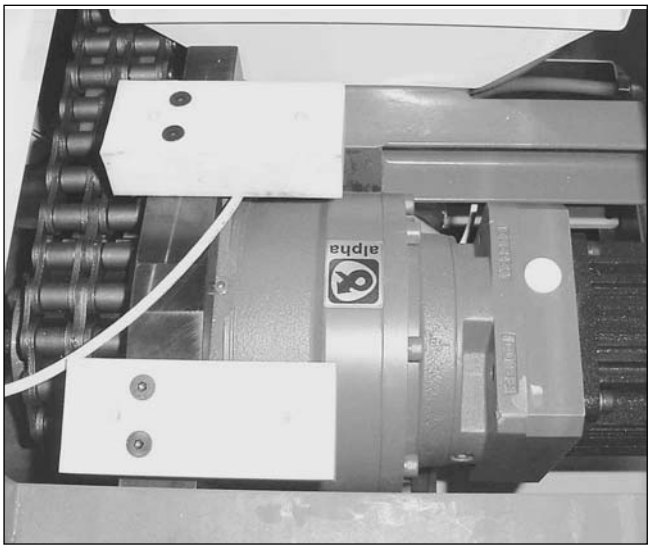


FIGURE 4-3, Stroking Gearbox

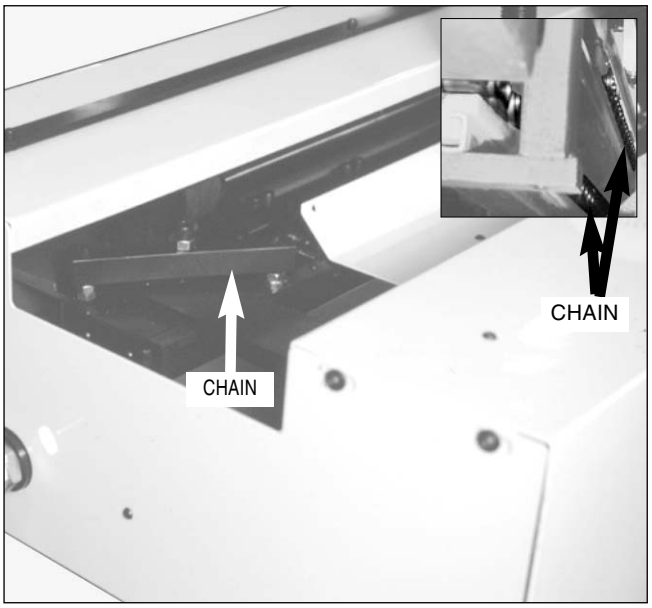


FIGURE 4-4, Chain

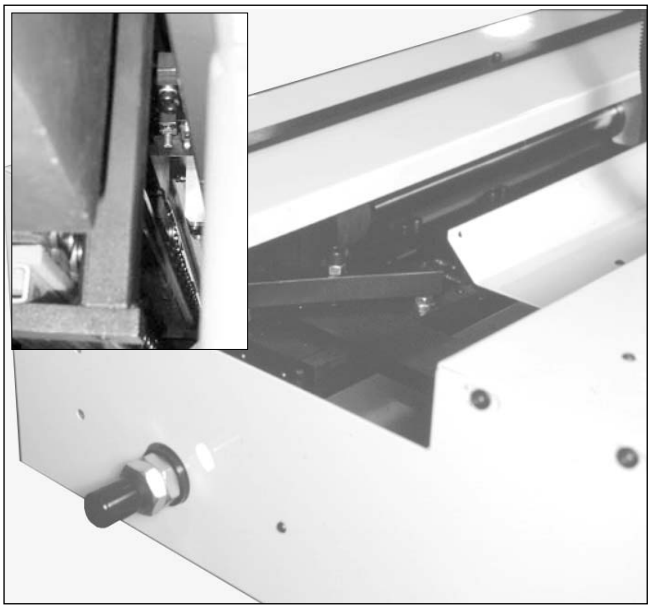


FIGURE 4-5, Chain

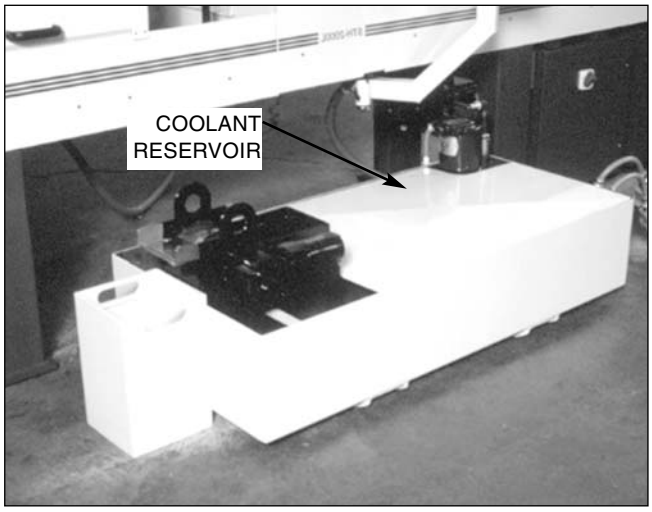


FIGURE 4-6, Coolant Reservoir

NOTES

SECTION 5
TROUBLESHOOTING

GENERAL

This section contains Troubleshooting information in table form, which should be used when problems occur with machine. The table lists problems encountered, possible causes, and solutions for problems along with reference to section of manual where detailed instructions may be found to correct problems.

OPERATIONAL TROUBLESHOOTING

For suggestions on correcting problems with bore conditions or with honing operation; consult Table 5-1.

TABLE 5-1, Operational Troubleshooting Index

PROBLEM	PROBABLE CAUSE	SOLUTIONS	SEC.
Stone not cutting	1. Stone Glazing	A. Dress stone	
		B. Increase cutting pressure	
		C. Increase stroking speed	
		D. Use softer stone	
		E. Check coolant*	4
	2. Stone Loading	A. Dress stone	
		B. Increase stroking speed	
		C. Use softer stone	
		D. Use coarser stone	
		E. Check coolant*	4
	3. Load Meter needs calibration.	A. Calibrate Load Meter	3
Slow stock removal	1. Improper spindle speed	A. Increase spindle speed	
	2. Inadequate stone feed up	A. Increase cutting pressure	
	3. Improper stone	A. Use softer stone	
		B. Use coarser stone	
	4. Improper or diluted coolant*	A. Check coolant*	4
	5. Load Meter needs calibration.	A. Calibrate Load Meter	3
Poor stone life	1. Excessive stone feed up	A. Decrease cutting pressure	2
	2. Inadequate spindle speed	A. Increase spindle speed	2
	3. Improper stone	A. Use harder stone	
		B. Use coarser stone	
	4. Improper or dilute coolant*	A. Check coolant*	4
	5. Load Meter needs calibration.	A. Calibrate Load Meter	3
Bellmouth (Bore longer than 2/3 stone length)	1. Mandrel not trued	A. True stone & shoes	
	2. Short or unbalanced part	A. Shorten stroke length	2
	3. Improper stone	A. Use softer stone	
	4. Improper stone length	A. Shorten stone only slightly on each end	
Bellmouth (Bore shorter than 2/3 stone length)	1. Mandrel not trued	A. True stone & shoes	
	2. Short or unbalanced part	A. Shorten stroke length	2
	3. Improper stone	A. Use softer stone	
	4. Improper stone length	A. Shorten stone & shoes equally to 1-1/2 times bore length	

*NOTE: Many honing problems, such as poor stone life, and rough finish, are caused by wrong coolant; insufficient coolant, dirty coolant, or contaminated coolant. Use ONLY clean, Sunnen Industrial Honing Oils or Water-Based Coolant. Make sure that coolant is neither diluted nor "cut" with other coolants. Keep solvents and cleaning fluids away from Machine.

PROBLEM	PROBABLE CAUSE	SOLUTIONS	SEC.
Barrel	1. Mandrel not trued	A. True stone & shoes	
	2. Improper stone length	A. Use longer stone or shorten guide shoes on both ends	
		B. Use mandrel with longer stone & shoes	
	3. Improper stone	A. Use finer stone	
Taper in Open Hole	1. Workpiece is not being reversed	A. Reverse workpiece on mandrel	
	2. Mandrel not trued	A. True stone & shoes	
	3. Improper stroke	A. Lengthen overstroke on tight end	
	4. Stroker Arm and Spindle not aligned	A. Align Stroker Arm and Spindle	
Taper in Blind Hole	1. Improper stone length	A. Shorten stone and shoes to 3/4 length of bore	
		B. True stone & shoes frequently	
	2. Inadequate oil flow	A. Adjust Oil Nozzle	
	3. Inadequate relief in blind end	A. Provide sufficient relief	
		B. Short stroke tight end	
		C. Use hard tip stone	
Out-Of-Round	1. Undersize honing tool	A. Change honing tool	2
	2. Mandrel not true	A. True stone & shoes	
	3. Workpiece flexing (thinwall)	A. Decrease cutting pressure	2
	4. Improper stone	A. Use softer stone	
Waviness	1. Improper mandrel or stone length	A. Use mandrel with sufficient stone length to bridge waviness in bore	
Rainbow	1. Improper mandrel	A. Use L, BL or multi-stone mandrel (stone length should be 1-1/2 times bore length	
	2. Improper stroke	A. Shorten overstroke	
	3. Improper stone	A. Use softer stone	
Rough Finish	1. Improper feed	A. Decrease cutting pressure	2
	2. Mandrel not trued	A. True stone & shoes to exact hole dia.	
	3. Improper stone	A. Use finer stone	
	4. Improper or diluted coolant*	A. Check coolant*	4
	5. Soft or exotic materials	A. Use bronze mandrel or bronze shoes	
Scratches in Bore (Random)	1. Improper feed	A. Decrease cutting pressure	2
	2. Improper stone	A. Use finer stone	
		B. Use softer stone	
	3. Improper mandrel	A. If using hard steel mandrel, change to soft steel mandrel; If using soft steel mandrel, change to bronze mandrel	
	4. Improper or diluted coolant*	A. Check coolant*	4

*NOTE: Many honing problems, such as poor stone life, and rough finish, are caused by wrong coolant; insufficient coolant, dirty coolant, or contaminated coolant. Use ONLY clean, Sunnen Industrial Honing Oils or Water-Based Coolant. Make sure that coolant is neither diluted nor "cut" with other coolants. Keep solvents and cleaning fluids away from Machine.

CHECKLIST
SETUP & OPERATION SEQUENCE

SETUP - WORKHOLDING FIXTURE (Section 2)

☐ Install and position the Workholding Fixture.

SETUP - HONING TOOL (Section 2)

☐ 1. Assemble Honing Tool.
☐ 2. Press K12 and slide Spindle Carriage to the left.
☐ 3. Swing Tool Support Bar into load position.
☐ 4. Rest Honing Tool on Tool Support Bar.
☐ 5. Install Honing Tool.
☐ 6. Guide Honing Tool into bore by sliding Spindle Carriage to right.
☐ 7. Press K11 to lock spindle carriage in position.
☐ 8. Press K10 to expand stone in workpiece bore.
☐ 9. Retract stones slightly by pressing K9.
☐ 10. Swing Tool Support Bar into operating position.

OPERATION (Section 3)

☐ 1. Assemble Honing Tool.
☐ 2. Turn ON Main Power.
☐ 3. Release Emergency STOP Button.
☐ 4. Press Power ON Button.
☐ 5. Press ACK.
☐ 6. Press K1.
☐ 7. If required: Press K2.
☐ 8. Press K15.
☐ 9. Connect Honing Tool: Use Joystick to move Carriage.
☐ 10. Press K10 to feed out stones.
☐ 11. Swing Tool Support Bar into operating position.
☐ 12. Press K9 to retract stones slightly.
☐ 13. Use Joystick to set overstroke on left end of Workpiece.
☐ 14. Press F2.
☐ 15. Press.K6.
☐ 16. Set Left Safety Switch Activator.
☐ 17. Use Joystick to set overstroke on right end of Workpiece.
☐ 18. Press K7.
☐ 19. Set Right Safety Switch Activator.
☐ 20. Cursor down to Honing Cycle Time, enter desired time and press ENTER.
☐ 21. Cursor down to Run Out Stroke Count, enter desired number of strokes and press ENTER.
☐ 22. Cursor down to Dwell Time, enter desired time, and press ENTER.
☐ 23. Press F7 to select desired Dwell Location.
☐ 24. Cursor down to Manual Short Stroke (Forward) Distance, enter desired distance and press ENTER.
☐ 25. Cursor down to Manual Short Stroke (Back) Distance, enter desired distance and press ENTER.
☐ 26. Cursor down to Auto Short Stroke Distance, enter distance and press ENTER.
☐ 27. Cursor down to Auto Short Stroke Time, enter desired time and press ENTER.
☐ 28. If desired: Press F8 to release Spindle Brake.
☐ 29. Press F3.
☐ 30. Press F5, Load Meter Sensitivity *(If Available)*; cursor down to Jog in Auto Feed Rate and press ENTER.

CONTINUED

OPERATION (Cont'd)

- ☐ 31. Cursor down to Enter Auto Retract Time, enter desired time and press ENTER.
- ☐ 32. Use Joystick to set tool to middle of Workpiece.
- ☐ 33. Set Spindle Speed.
- ☐ 34. Disconnect Honing Tool.
- ☐ 35. Install U-Joint Stabilizer.
- ☐ 36. Press F6.
- ☐ 37. Follow directions on screen and press F8.
- ☐ 38. Connect Honing Tool.
- ☐ 39. Press F1.
- ☐ 40. Set Stroke Rate / Reciprocation Speed and press ENTER.
- ☐ 41. Hold Joystick in Inch Reverse direction, until tool is even with left end of workpiece.
- ☐ 42. Set Feed Rate.
- ☐ 43. Position Coolant Nozzle.
- ☐ 44. Open Flow Control Valve.
- ☐ 45. Install and position Splash Guards.
- ☐ 46. Swing Tool Support Bar into operating position.
- ☐ 47. Recheck all values entered in Control Panel.
- ☐ 48. Press K2 until LED is ON.
- ☐ 49. Press Cycle Ready/Start Button to start Honing Cycle.
  Machine will stop when Run Out Stroke Counter reaches zero (0) and honing cycle ends.
- ☐ 50. Press K2 until LED is OFF.
- ☐ 51. Retract stones slightly by pressing K9.
- ☐ 52. Swing Tool Support into Load Position.
- ☐ 53. Press K12 and slide spindle carriage to the left.
- ☐ 54. Slide Honing Tool out of Bore.

CHECKLIST
WORK CYCLE SEQUENCE

NOTE: The following sequence is for when machine is set up and machine is ready to start next honing cycle with previously selected values.

IMPORTANT: Workpiece MUST maintain old position.

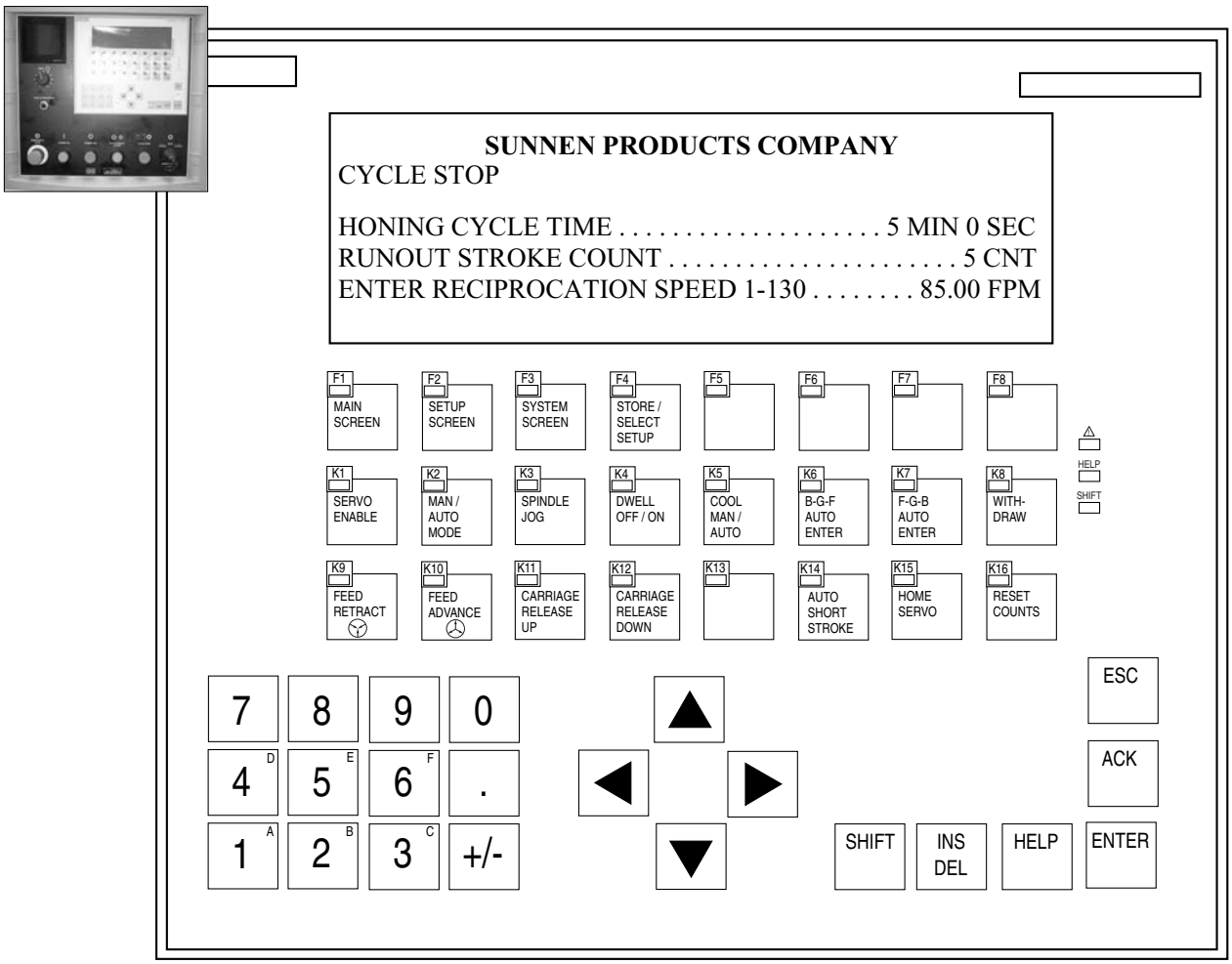
CONTINUING OPERATION / WORK CYCLE SEQUENCE

- ☐ 1. Load new workpiece into fixture in same position as previous workpiece.
- ☐ 2. Guide Honing Tool into bore by sliding Spindle Carriage to right.
- ☐ 3. Press K11 to lock spindle carriage in position.
- ☐ 4. Press K10 to expand stone in workpiece bore.
- ☐ 5. Retract stones slightly by pressing K9.
- ☐ 6. Swing Tool Support Bar into operating position
- ☐ 7. Press K2 until LED is ON.
- ☐ 8. Press Cycle Ready/Start Button to start Honing Cycle.
- ☐ 9. Machine will stop when Run Out Stroke Counter reaches zero (0) and honing cycle ends.
- ☐ 10. Retract stones slightly by pressing K9.
- ☐ 11. Swing Tool Support into Load Position.
- ☐ 12. Press K12 and slide spindle carriage to the left.
- ☐ 13. Slide Honing Tool out of Bore

NOTES

SCREENS

MAIN SCREEN



LINE 1 (LEFT): Displays current Honing Cycle.
CYCLE STOP or CYCLE RUN

LINE 1 (RIGHT): Displays various messages.
TOOL IN WITHDRAW, RECIPROCATION, POSITIONS ENTERED INCORRECTLY

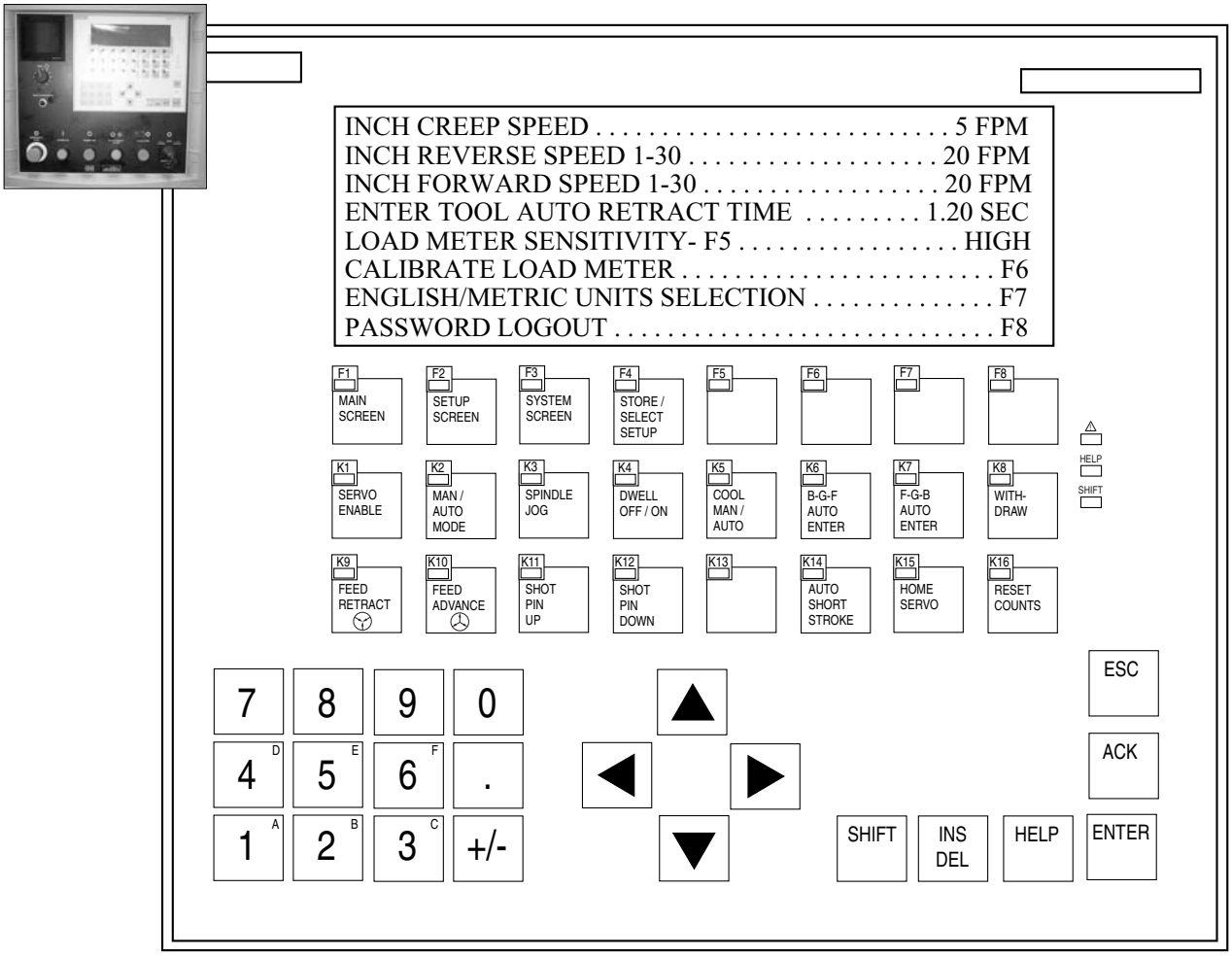
LINE 2: Displays current Honing Time remaining in the HONING CYCLE.

LINE 3: Displays current number of Runout Strokes remaining in the RUNOUT CYCLE.

LINE 4: Operator entry of desired Reciprocation Rate for HONING CYCLE or RUNOUT CYCLE.

SCREENS

SYSTEM SCREEN


INCH CREEP SPEED . . . . . 5 FPM
INCH REVERSE SPEED 1-30 . . . . . 20 FPM
INCH FORWARD SPEED 1-30 . . . . . 20 FPM
ENTER TOOL AUTO RETRACT TIME . . . . . 1.20 SEC
LOAD METER SENSITIVITY- F5 . . . . . HIGH
CALIBRATE LOAD METER F6
ENGLISH/METRIC UNITS SELECTION F7
PASSWORD LOGOUT F8
F1 MAIN SCREEN
F2 SETUP SCREEN
F3 SYSTEM SCREEN
F4 STORE / SELECT SETUP
F5
F6
F7
F8
K1 SERVO ENABLE
K2 MAN / AUTO MODE
K3 SPINDLE JOG
K4 DWELL OFF / ON
K5 COOL MAN / AUTO
K6 B-G-F AUTO ENTER
K7 F-G-B AUTO ENTER
K8 WITH-DRAW
K9 FEED RETRACT
K10 FEED ADVANCE
K11 SHOT PIN UP
K12 SHOT PIN DOWN
K13
K14 AUTO SHORT STROKE
K15 HOME SERVO
K16 RESET COUNTS
HELP
SHIFT
7 8 9 0
4 D 5 E 6 F .
1 A 2 B 3 C +/-
ESC
ACK
SHIFT
INS DEL
HELP
ENTER

LINE 1: Operator entry of desired Reciprocation Rate spindle carriage will travel at, during initial three (3) seconds of INCH FORWARD or INCH REVERSE. Also Reciprocation Rate spindle carriage will travel at during HOME SERVO.

LINE 2: Operator entry of desired Reciprocation Rate spindle carriage will travel at, after initial three (3) seconds of INCH FORWARD.

LINE 3: Operator entry of desired Reciprocation Rate spindle carriage will travel at, after initial three (3) seconds of INCH REVERSE.

LINE 4: Operator entry of desired Tool Retract Time at end of cycle.

LINE 5: Sets output torque from feed motor. Also calibrates load meter range to match selected output torque. *(Available on L-Series ONLY.)*

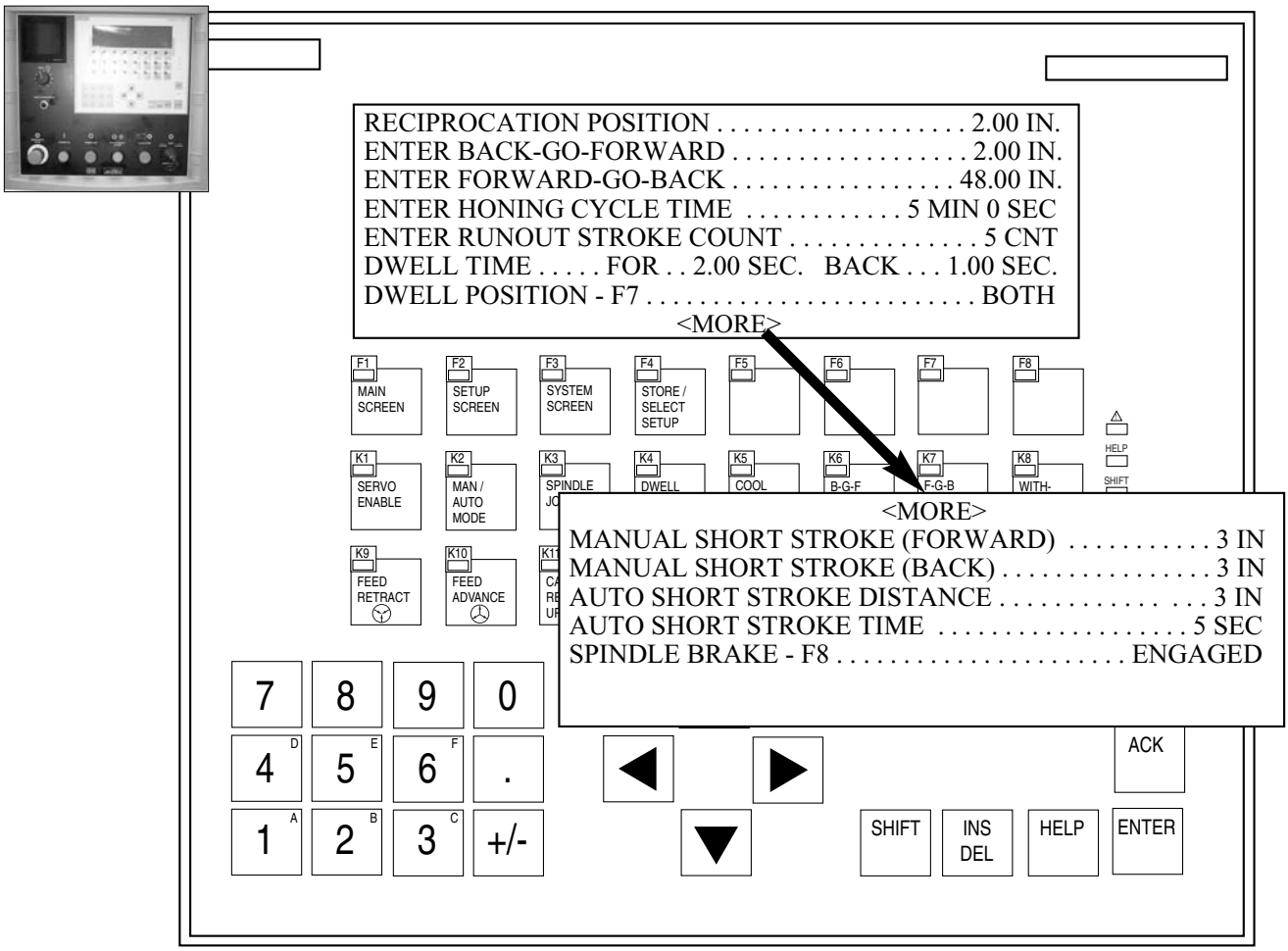
LINE 6: Calibrates Load Meter depending on spindle speed. (Do this after any speed change.)
When F6 - Calibrate Load Meter is pressed, the following screen will appear:
Spindle will start rotating upon calibration start. Has all tooling been removed and brake engaged? If so, press F7 to begin calibration. If not, press F8 to return to system screen.

LINE 7: Operator entry to select ENGLISH or METRIC Units of Measurement.

LINE 8: Supervisor entry to reset PASSWORD Required Circuit. (Prevents various password protected parameters from being altered.)

SCREENS

SETUP SCREEN


RECIPROCATION POSITION . . . . . 2.00 IN.
ENTER BACK-GO-FORWARD . . . . . 2.00 IN.
ENTER FORWARD-GO-BACK . . . . . 48.00 IN.
ENTER HONING CYCLE TIME . . . . . 5 MIN 0 SEC
ENTER RUNOUT STROKE COUNT . . . . . 5 CNT
DWELL TIME . . . . . FOR . . 2.00 SEC. BACK . . . 1.00 SEC.
DWELL POSITION - F7 . . . . . BOTH
<MORE>
F1 MAIN SCREEN
F2 SETUP SCREEN
F3 SYSTEM SCREEN
F4 STORE / SELECT SETUP
F5
F6
F7
F8
K1 SERVO ENABLE
K2 MAN / AUTO MODE
K3 SPINDLE JO
K4 DWELL
K5 COOL
K6 B-G-F
K7 F-G-B
K8 WITH-
K9 FEED RETRACT
K10 FEED ADVANCE
<MORE>
MANUAL SHORT STROKE (FORWARD) . . . . . 3 IN
MANUAL SHORT STROKE (BACK) . . . . . 3 IN
AUTO SHORT STROKE DISTANCE . . . . . 3 IN
AUTO SHORT STROKE TIME . . . . . 5 SEC
SPINDLE BRAKE - F8 . . . . . ENGAGED
HELP
SHIFT
7 8 9 0
4 5 6 .
1 2 3 +/-
ACK
SHIFT
INS DEL
HELP
ENTER

LINE 1: Displays current Reciprocation Position of spindle carriage in relation to HOME POSITION.

LINE 2: Operator entry of desired BACK-GO-FORWARD Reciprocation Reversal Set Point.

LINE 3: Operator entry of desired FORWARD-GO-BACK Reciprocation Reversal Set Point.

LINE 4: Operator entry of desired Cycle Time to be completed during HONING CYCLE.

LINE 5: Operator entry of desired Number of Reciprocation Strokes to be completed during RUNOUT CYCLE.

LINE 6: Operator entry of desired Reciprocation DWELL TIME (Forward & Back Positions). (Only active when K4 Dwell Off/On Keypad is turned ON.)

LINE 7: Operator entry to select desired Reciprocation DWELL POSITION. (Back, Forward, Both)

<MORE> This screen has more text lines accessed by cursoring down.

LINE 8: Operator entry to set Manul Short Stroke (Forward) Distance.

LINE 9: Operator entry to set Manul Short Stroke (Back) Distance.

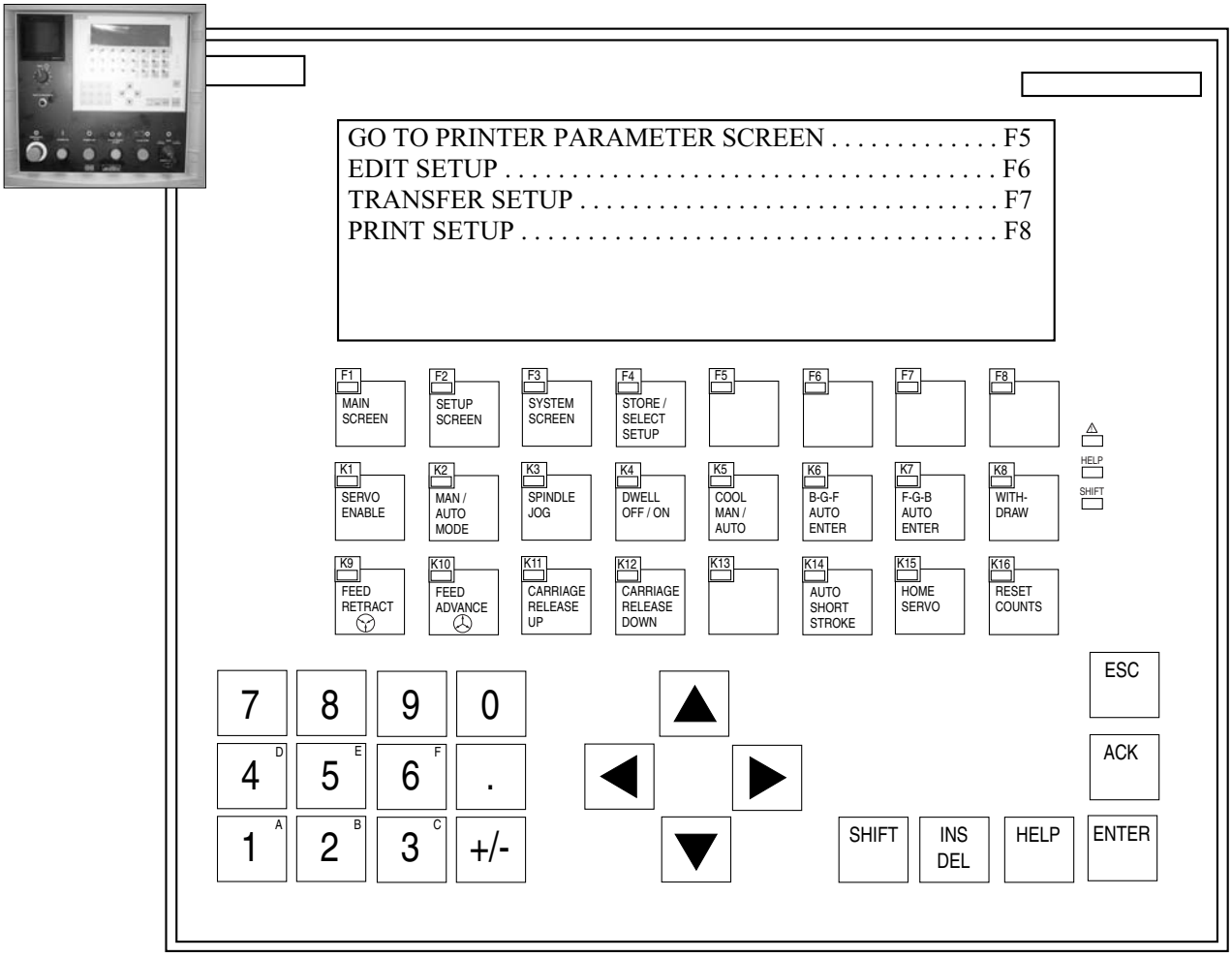
LINE 10: Operator entry to select desired AUTO SHORT STROKE (FORWARD). (Only active whenK14 Auto Short Stroke Off/On Keypad is turned ON.)

LINE 11: Operator entry to select desired AUTO SHORT STROKE TIME. (Only active when K14 Auto Short Stroke Off/On Keypad is turned ON.)

LINE 12: Engages and disengages Spindle Brake. (F8 in this Screen.)

SCREENS

STORE / SELECT SETUP SCREEN



LINE 1: Displays to access the PRINTER PARAMETER SCREEN.

LINE 2: Displays to access the EDIT SETUP SCREEN.

LINE 3: Displays to access the TRANSFER SETUP SCREEN.

LINE 4: Displays to access the PRINT SETUP SCREEN.

CALCULATIONS
FORMULAS

STOCK REMOVAL in cm^3

$$\text{STOCK REMOVAL} = \frac{Ø \times \text{Length} \times \text{Stock Removal}}{636} = cm^3$$

EXAMPLE: $\frac{100\ mm \times 1200\ mm \times 0{,}28\ mm}{636} = 52{,}8\ cm^3$

HONING TIME in minutes (320 cm3/h)

$$\text{HONING TIME} = \frac{Ø \times \text{Length} \times \text{Stock Removal}}{3400} = \text{min.}$$

EXAMPLE: $\frac{100\ mm \times 1200\ mm \times 0{,}28\ mm}{3400} = 10\ \text{min.}$

Stock Removal for SURFACE FINISH

$$\text{Required Stock Removal on } Ø = \frac{\text{Existing Finish - Desired Finish}}{100} = mm$$

EXAMPLE: $\frac{0.8\ Ra\ (N6) - 0.1\ Ra\ (N3)}{100} = 0{,}007\ mm$

STONE CONSUMPTION

One Set of Stones consists of 4 Sticks 0,85 cm x 0,85 cm x10.2 cm long = 29.48 cm3 in one set of H70-A45N Stones. On the assumption of stone wear being at a ratio of 1:25 to Material Removed

= 29.48 x 25 = 737 cm3 material removed with one set of H70 Stones

$$\text{Parts per Set of Stone} = \frac{737\ cm^3}{\text{Stock Removal}} = \text{Parts}$$

EXAMPLE: $\frac{737\ cm3}{52.8\ cm^3} = 14$ Parts per Set of Stone

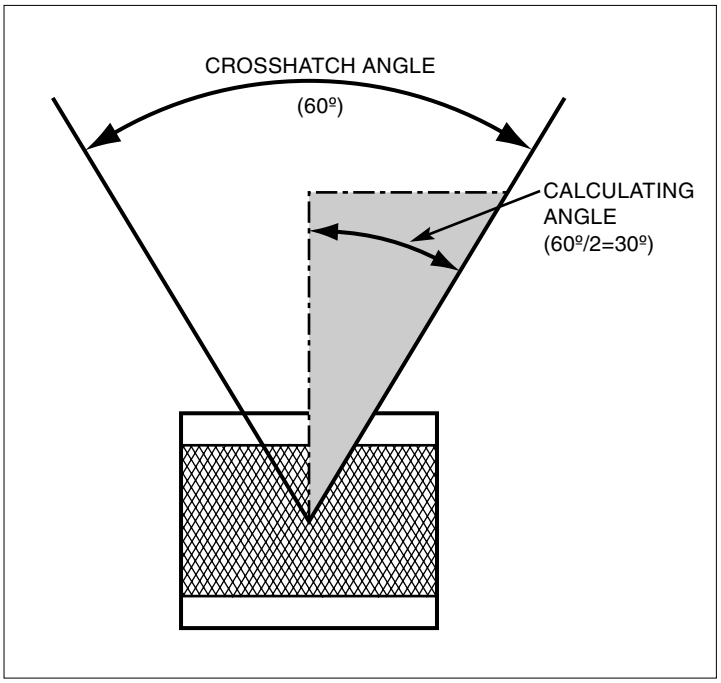
CROSSHATCH ANGLE

30° = tg 15° (0,2679)

45° = tg 22,5° (0,4142)

60° = tg 30° (0,5774)

90° = tg 45° (1,0)



EXAMPLE TO CALCULATE:

Bore Diameter: = 100 mm

RPM: = 175

Crosshatch Angle: = 60°

V m/min: = ??

To calculate the Crosshatch Angle consult following Formulas:

$$\text{Stroke Speed V (m/min.)} = \frac{Ø \times 3{,}14 \times RPM \times \text{tg}(30°)}{1000} = \text{m/min}$$

EXAMPLE:

$$\frac{100 \times 3{,}14 \times 175 \times 0{,}5774}{1000} = 31{,}73 \text{ m/min}$$

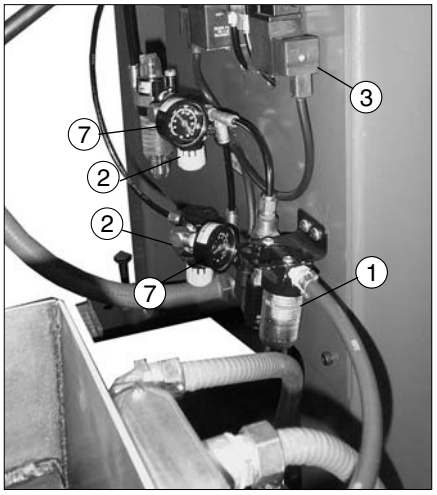
$$\text{Spindle Speed RPM} = \frac{1000 \times V\ (\text{m/min})}{Ø \times 3{,}14 \times \text{tg}(30°)} = \text{RPM}$$

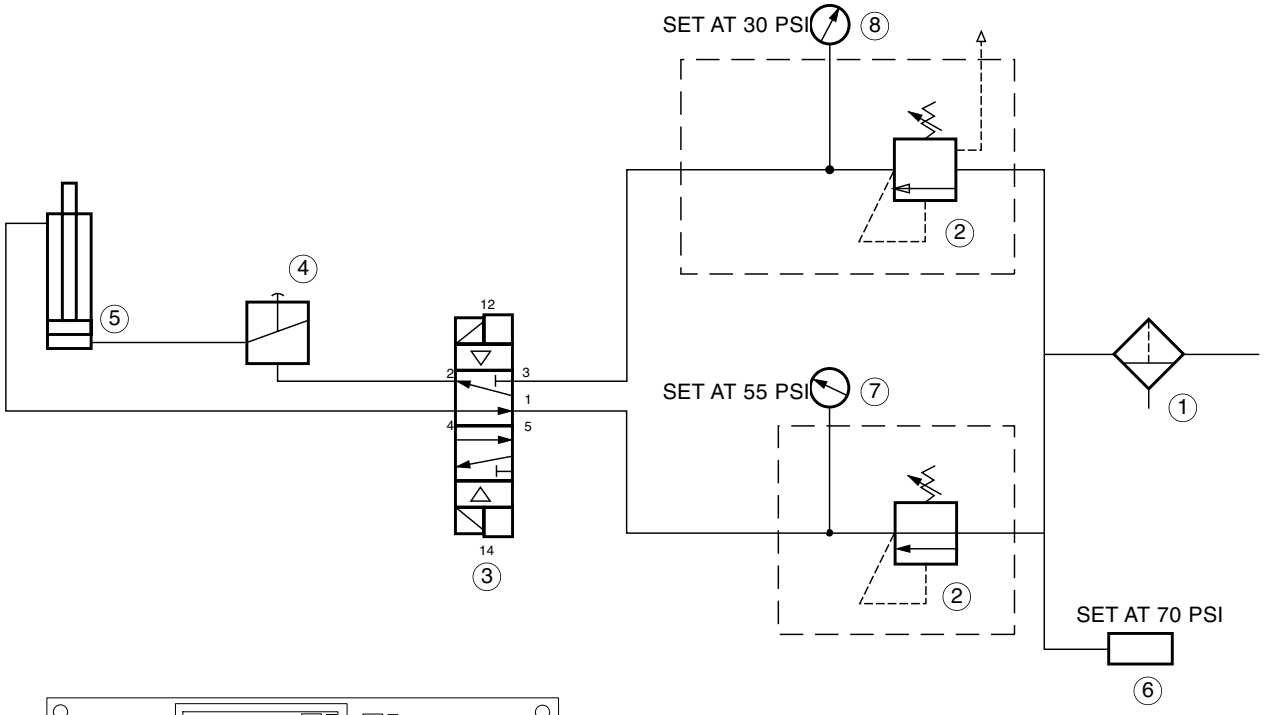
EXAMPLE:

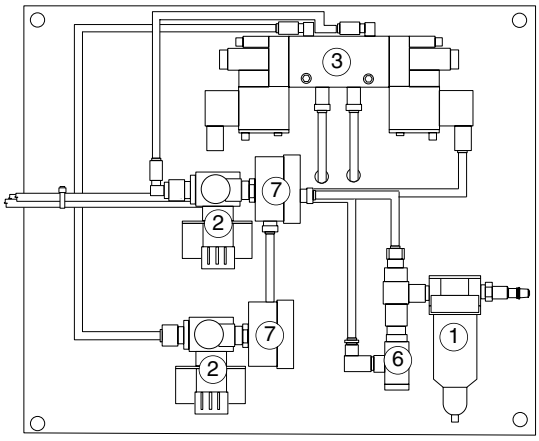
$$\frac{1000 \times 30}{100 \text{ mm} \times 3{,}14 \times \text{tg } 0{,}5774} = 165{,}5 \text{ RPM}$$

PNEUMATIC FLOW DIAGRAM

1 . . . . Filter
2 . . . . Pressure Regulator
3 . . . . Valve
4 . . . . Valve
5 . . . . Carriage Release Cylinder
6 . . . . Air Pressure Switch
7 . . . . Gage

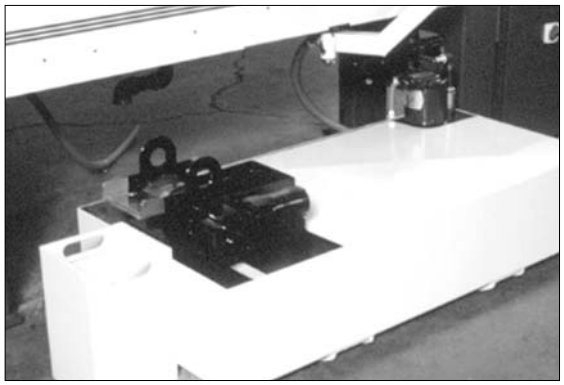


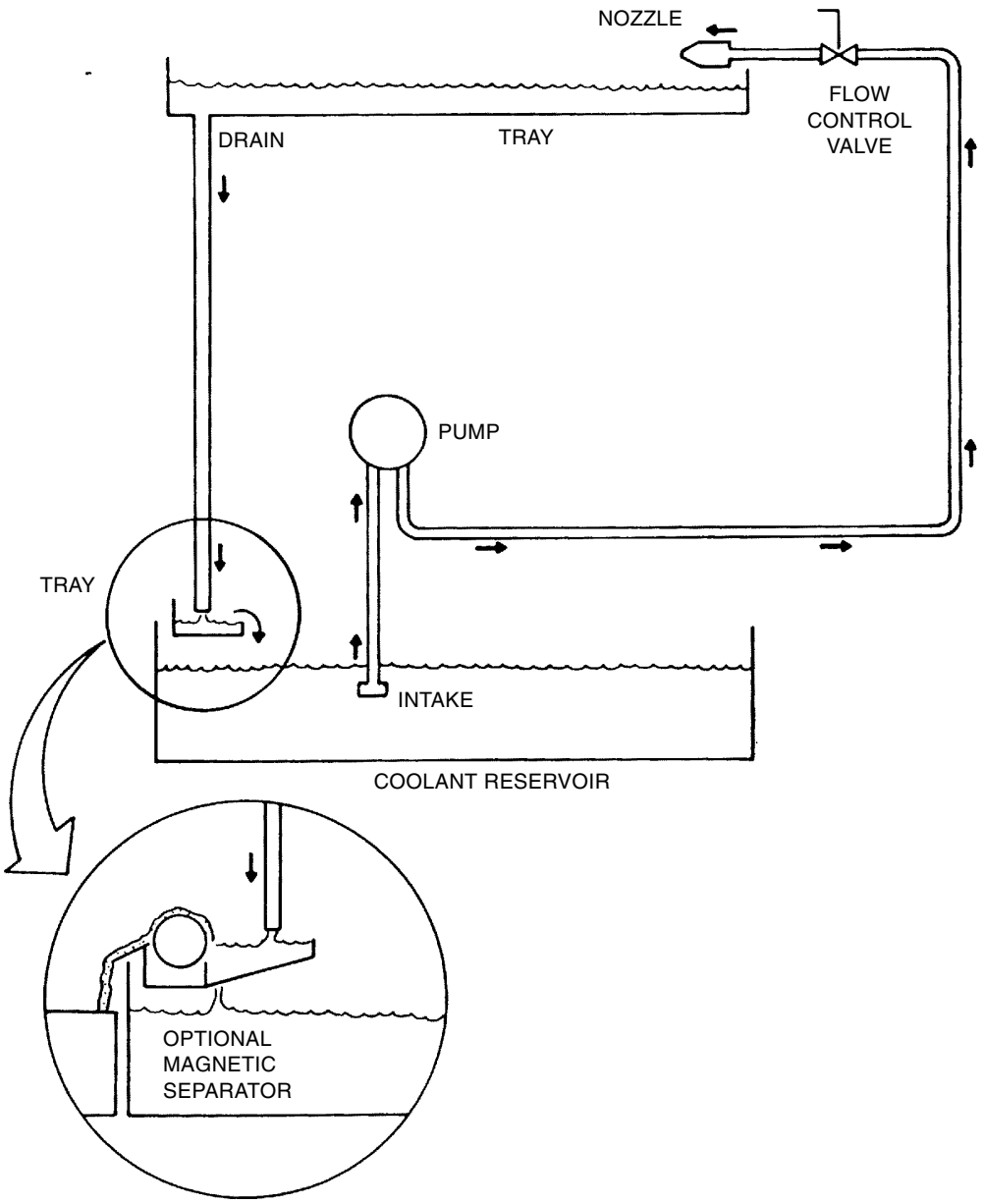




COOLANT FLOW DIAGRAM

CENTRIFUGAL PUMP





SURFACE ROUGHNESS TABLE

Rt µm	**Rz** µm	**N 1 - N10**	**Ra / CLA** µm	µin.	**RMS** µin.	**GUS** Knocc
0,1 - 0,3	0,17	N 1	0,02	0,8	0,9 - 1,0	14
0,2 - 0,5	0,30	N 2	0,04	1,6	1,8 - 1,9	13
0,3 - 0,7	0,43	--	0,06	2,4	2,6 - 2,9	12
0,4 - 0,8	0,52	N 3	0,08	3,2	3,5 - 3,8	11
0,5 - 1,0	0,65	--	0,10	4,0	4,4 - 4,8	--
0,6 - 1,2	0,77	N 4	0,12	4,8	5,3 - 5,8	--
0,65 - 1,4	0,86	--	0,14	5,6	6,2 - 6,8	--
0,7 - 1,6	1,00	--	0,16	6,4	7,0 - 7,7	--
0,8 - 1,7	1,07	--	0,18	7,2	7,9 - 8,6	10
0,9 - 1,9	1,20	--	0,20	8,0	8,8 - 9,6	--
1,1 - 2,3	1,45	N 5	0,25	10,0	11,0 - 12,0	--
1,3 - 2,7	1,70	--	0,30	12,0	13,2 - 14,4	--
1,5 - 3,0	1,95	--	0,35	14,0	15,4 - 16,8	--
1,7 - 3,4	2,20	--	0,40	16,0	17,6 - 19,2	9
1,9 - 3,8	2,45	N 6	0,45	18,0	19,8 - 21,6	--
2,3 - 4,2	2,70	--	0,50	20,0	22,0 - 24,0	--
2,7 - 5,2	3,45	--	0,65	26,0	28,6 - 31,2	8
3,7 - 7,0	4,60	N 7	0,90	36,0	39,6 - 43,2	--
4,5 - 8,2	5,45	--	1,10	44,0	48,4 - 52,8	--
5,2 - 9,5	6,35	--	1,30	52,0	57,0 - 62,0	7
6,0 - 10,0	7,10	--	1,50	60,0	66,0 - 72,0	--
7,1 - 12,5	8,45	N 8	1,80	72,0	79,0 - 86,0	--
9,6 - 16,5	11,20	--	2,50	100,0	110 - 120	6
13,0 - 22,0	15,10	N 9	3,50	140,0	154 - 168	--
17,0 - 28,0	19,40	--	4,50	180,0	198 - 216	--
18,0 - 30,0	20,60	--	5,00	200,0	220 - 240	5
22,0 - 35,0	24,50	--	6,00	240,0	264 - 288	--
25,0 - 40,0	27,90	N10	7,00	280,0	308 - 336	--
28,0 - 45,0	31,40	--	8,00	320,0	352 - 384	--

FIXTURE HEIGHT CHARTS
(L-SERIES)

HOW TO USE FIXTURE HEIGHT CHART

Find Workpiece O.D. by reading across the top and down the left side of the chart. Where the column and line intersect is the approximate height at which the fixture should be set.

EXAMPLE: *OD of Workpiece is 165 mm*

Find column 150 mm on top of chart, move down the column until it intersects line 15. For this example the Fixture should be set at 192 mm.

Standard Fixture - Inverted (30-177mm / 1.2-6.9in.)

MILLIMETERS

+mm	30	60	90	120	150
0	265	248	231	214	199
3	263	246	229	212	198
6	261	244	228	211	196
9	260	242	226	209	195
12	258	241	224	208	193
15	257	239	222	206	192
18	255	237	220	204	190
21	253	236	218	202	188
24	252	234	216	201	187
27	250	233	215	200	186

NORMAL

INCHES

+ in.	1.2	2.3	3.5	4.7	5.9
0.0	10.4	9.8	9.1	8.4	7.8
0.1	10.4	9.7	9.0	8.3	7.8
0.2	10.3	9.6	9.0	8.3	7.7
0.4	10.2	9.5	8.9	8.2	7.7
0.5	10.2	9.5	8.8	8.2	7.6
0.6	10.1	9.4	8.7	8.1	7.6
0.7	10.0	9.3	8.7	8.0	7.5
0.8	10.0	9.3	8.6	8.0	7.4
0.9	9.9	9.2	8.5	7.9	7.4
1.1	9.8	9.2	8.5	7.9	7.3

NORMAL

NOTE: Refers to Outside Diameter of Workpiece.

Standard Fixture - Normal (75-375mm / 3.0-14.7in.)

MILLIMETERS

+mm	60	90	120	150	180	210	240	270	300	330	360
0	--	207	189	173	153	135	119	103	87	71	56
3	--	206	187	171	151	133	117	101	86	70	54
6	--	204	185	169	149	131	115	99	84	68	52
9	--	203	183	167	147	130	114	98	83	67	51
12	--	201	181	165	146	128	113	97	81	65	49
15	215	198	179	163	144	127	112	96	80	64	--
18	214	196	178	161	142	125	110	94	78	62	--
21	212	194	177	159	140	124	108	92	76	60	--
24	210	192	176	157	139	122	106	90	74	58	--
27	209	190	175	155	137	121	105	89	73	57	--

INCHES

+in.	2.3	3.5	4.7	5.9	7.1	8.3	9.5	10.6	11.8	12.9	14.2
0.0	--	8.1	7.4	6.8	6.0	5.3	4.7	4.1	3.4	2.8	2.2
0.1	--	8.1	7.4	6.7	5.9	5.2	4.6	4.0	3.4	2.8	2.1
0.2	--	8.0	7.3	6.7	5.9	5.2	4.5	3.9	3.3	2.7	2.0
0.4	--	8.0	7.2	6.6	5.8	5.1	4.5	3.9	3.3	2.6	2.0
0.5	--	7.9	7.1	6.5	5.7	5.0	4.4	3.8	3.2	2.6	1.9
0.6	8.5	7.8	7.0	6.4	5.7	5.0	4.4	3.8	3.1	2.5	--
0.7	8.4	7.7	7.0	6.3	5.6	4.9	4.3	3.7	3.1	2.4	--
0.8	8.3	7.6	7.0	6.3	5.5	4.9	4.3	3.6	3.0	2.4	--
0.9	8.3	7.6	6.9	6.2	5.5	4.8	4.2	3.5	2.9	2.3	--
1.1	8.2	7.5	6.9	6.1	5.4	4.8	4.1	3.5	2.9	2.2	--

NOTE: Refers to Outside Diameter of Workpiece.

Special Fixture - w/Prism Plate (350-510mm / 13.8-20.1in.)

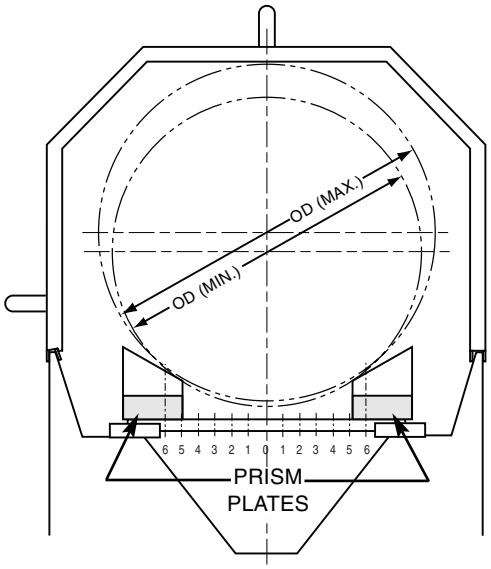
	Pos.	1	2	3	4	5	6
MILLIMETERS	min	350	370	400	430	450	480
	max	370	400	430	450	480	510
INCHES	Pos.	1	2	3	4	5	6
	min	13.8	14.6	15.8	16.9	17.7	18.9
	max	14.6	15.8	16.9	17.7	18.9	20.1

NOTE: Refers to Outside Diameter of Workpiece.

Special Fixture - wo/Prism Plate (470-600mm / 18.5-23.6in.)

	Pos.	1	2	3	4	5	6
MILLIMETERS	min	--	470	500	520	550	570
	max	--	500	520	550	570	600
INCHES	Pos.	1	2	3	4	5	6
	min	--	18.5	19.7	20.5	21.7	22.5
	max	--	19.7	20.5	21.7	22.5	23.6

NOTE: Refers to Outside Diameter of Workpiece.



FIXTURE HEIGHT CHARTS (H-SERIES)

HOW TO USE FIXTURE HEIGHT CHART

Find Workpiece O.D. by reading across the top and down the left side of the chart. Where the column and line intersect is the approximate height at which the fixture should be set.

EXAMPLE: *OD of Workpiece is 165 mm*

Find column 150 mm on top of chart, move down the column until it intersects line 15. For this example the Fixture should be set at 206 mm.

Fixture - Inverted (30-300mm / 1.2-11.8in.)

MILLIMETERS

+mm	30	60	90	120	150
0	--	262	245	228	213
3	--	260	243	226	212
6	--	258	242	225	210
9	--	256	240	223	209
12	--	255	238	222	207
15	--	253	236	220	206
18	--	251	234	218	204
21	--	250	232	216	202
24	--	248	230	215	201
27	--	247	229	214	200

INCHES

+ in.	1.2	2.3	3.5	4.7	5.9
0.0	--	10.3	9.6	9.0	8.4
0.1	--	10.2	9.6	8.9	8.3
0.2	--	10.2	9.5	8.9	8.3
0.4	--	10.1	9.4	8.8	8.2
0.5	--	10.0	9.4	8.7	8.1
0.6	--	10.0	9.3	8.7	8.1
0.7	--	9.9	9.2	8.6	8.0
0.8	--	9.8	9.1	8.5	8.0
0.9	--	9.8	9.1	8.5	7.9
1.1	--	9.7	9.0	8.4	7.9

NORMAL

NOTE: Refers to Out Side Diameter of Workpiece.

Fixture - Normal (180-405mm / 7.1-15.9in.)

MILLIMETERS

+mm	60	90	120	150	180	210	240	270	300	330	360
0	--	221	203	187	167	149	133	117	101	85	70
3	--	220	201	185	165	147	131	115	100	84	68
6	--	218	199	183	163	145	129	113	98	82	66
9	--	217	197	181	161	144	128	112	97	81	65
12	--	215	195	179	160	142	127	111	95	79	63
15	229	212	193	177	158	141	126	110	94	78	--
18	228	210	192	175	156	139	124	108	92	76	--
21	226	208	191	173	154	138	122	106	90	74	--
24	224	206	190	171	153	136	120	104	88	72	--
27	223	204	189	169	151	135	119	103	87	71	--

INCHES

+ in.	2.4	3.5	4.7	5.9	7.1	8.3	9.5	10.6	11.8	13.0	14.2
0.0	--	8.7	8.0	7.4	6.6	5.9	5.2	4.6	4.0	3.3	2.8
0.1	--	8.7	7.9	7.3	6.5	5.8	5.2	4.5	3.9	3.3	2.7
0.2	--	8.6	7.8	7.2	6.4	5.7	5.1	4.4	3.9	3.2	2.6
0.4	--	8.5	7.8	7.1	6.3	5.7	5.0	4.4	3.8	3.2	2.6
0.5	--	8.5	7.7	7.0	6.3	5.6	5.0	4.4	3.7	3.1	2.5
0.6	9.0	8.3	7.6	7.0	6.2	5.6	5.0	4.3	3.7	3.1	--
0.7	9.0	8.3	7.6	6.9	6.1	5.5	4.9	4.3	3.6	3.0	--
0.8	8.9	8.2	7.5	6.8	6.1	5.4	4.8	4.2	3.5	2.9	--
0.9	8.8	8.1	7.5	6.7	6.0	5.4	4.7	4.1	3.5	2.8	--
1.1	8.8	8.0	7.4	6.7	5.9	5.3	4.7	4.1	3.4	2.8	--

NOTE: Refers to Out Side Diameter of Workpiece.

Special Fixture - w/Prism Plate (350-530mm / 13.8-20.9in.)

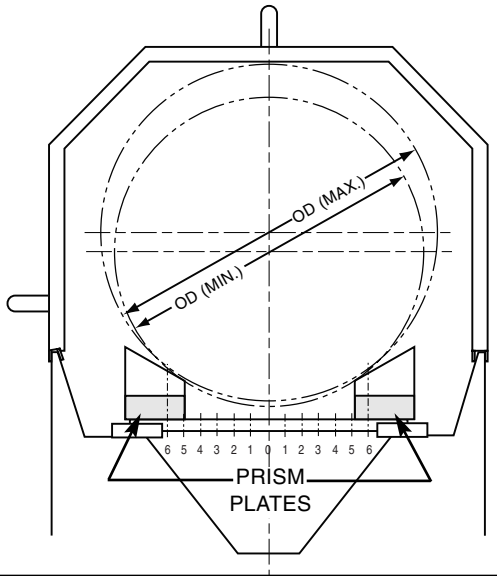
	Pos.	1	2	3	4	5	6
MILLIMETERS	min	--	350	380	420	460	500
	max	--	380	420	460	500	530
INCHES	Pos.	1	2	3	4	5	6
	min	--	13.8	15.0	16.5	18.1	19.7
	max	--	15.0	16.5	18.1	19.7	20.9

NOTE: Refers to Outside Diameter of Workpiece.

Special Fixture - wo/Prism Plate (500-700mm / 19.7-27.5in.)

	Pos.	1	2	3	4	5	6
MILLIMETERS	min	--	--	500	530	590	620
	max	--	--	530	590	620	700
INCHES	Pos.	1	2	3	4	5	6
	min	--	--	19.7	20.9	23.2	24.4
	max	--	--	20.9	23.2	24.4	27.6

NOTE: Refers to Outside Diameter of Workpiece.



FRACTION / DECIMAL / MILLIMETER EQUIVALENTS CHART

INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER
. . . .	.003937	0,1000	9/32	.281250	7,1438	21/32	.656250	16,6688
. . . .	.007874	0,2000	19/64	.296875	7,5406	. . . .	.669291	17,0000
. . . .	.011811	0,3000	5/16	.312500	7,9375	43/64	.671875	17,0656
1/64	.015625	0,3969	. . . .	.314961	8,0000	11/16	.687500	17,4625
. . . .	.015748	0,4000	21/64	.328125	8,3344	45/64	.703125	17,8594
. . . .	.019685	0,5000	11/32	.343750	8,7313	. . . .	.708661	18,0000
. . . .	.023622	0,6000	. . . .	.354331	9,0000	23/32	.718750	18,2563
. . . .	.027559	0,7000	23/64	.359375	9,1281	47/64	.734375	18,6531
1/32	.031250	0,7938	3/8	.375000	9,5250	. . . .	.748031	19,0000
. . . .	.031496	0,8000	25/64	.390625	9,9219	3/4	.750000	19,0500
. . . .	.035433	0,9000	. . . .	.393701	10,0000	49/64	.765625	19,4469
. . . .	.039370	1,0000	13/32	.406250	10,3188	25/32	.781250	19,8438
3/64	.046875	1,1906	27/64	.421875	10,7156	. . . .	.787402	20,0000
1/16	.062500	1,5875	. . . .	.433071	11,0000	51/64	.796875	20,2406
5/64	.078125	1,9844	7/16	.437500	11,1125	13/16	.812500	20,6375
. . . .	.078740	2,0000	29/64	.453125	11,5094	. . . .	.826772	21,0000
3/32	.093750	2,3813	15/32	.468750	11,9063	53/64	.828125	21,0344
7/64	.109375	2,7781	. . . .	.472441	12,0000	27/32	.843750	21,4313
. . . .	.118110	3,0000	31/64	.484375	12,3031	55/64	.859375	21,8281
1/8	.125000	3,1750	1/2	.500000	12,7000	. . . .	.866142	22,0000
9/64	.140625	3,5719	. . . .	.511811	13,0000	7/8	.875000	22,2250
5/32	.156250	3,9688	33/64	.515625	13,0969	57/64	.890625	22,6219
. . . .	.157480	4,0000	17/32	.531250	13,4938	. . . .	.905512	23,0000
11/64	.171875	4,3656	35/64	.546875	13,8906	29/32	.906250	23,0188
3/16	.187500	4,7625	. . . .	.551181	14,0000	59/64	.921875	23,4156
. . . .	.196850	5,0000	9/16	.562500	14,2875	15/16	.937500	23,8125
13/64	.203125	5,1594	37/64	.578125	14,6844	. . . .	.944882	24,0000
7/32	.218750	5,5563	. . . .	.590551	15,0000	61/64	.953125	24,2094
15/64	.234375	5,9531	19/32	.593750	15,0813	31/32	.968750	24,6063
. . . .	.236220	6,0000	39/64	.609375	15,4781	. . . .	.984252	25,0000
1/4	.250000	6,3500	5/8	.625000	15,8750	63/64	.984375	25,0031
17/64	.265625	6,7469	. . . .	.629921	16,0000	1	1.000000	25,4000
. . . .	.275591	7,0000	41/64	.640625	16,2719	1-1/16	1.062500	26,9880

FORMULAS:

MULTIPLY		BY		TO GET
INCHES (in)	x	25.4	=	MILLIMETERS (mm)
FEET (ft)	x	0.3048	=	METERS (m)

MULTIPLY		BY		TO GET
MILLIMETERS (mm)	x	0.03937	=	INCHES (in)
METERS (m)	x	3.281	=	FEET (ft)

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